VOLUME 36
NUMBER 7

JULY, 1949

plating

ELECTROLYTIC TIN PLATE

See Contents Page 699

COST REDUCER and TIME SAVER

CLEPO 10-D PROCESS

FOR CLEANING AND BURNISHING STEEL PARTS IN ONE OPERATION WITHOUT USING BURNISHING SHOT

The Clepo 10-D Process greatly reduces the operation time and also the high cost of the conventional method of soak cleaning plus ball burnishing.

The Clepo 10-D Process is adaptable for use in either oblique or horizontal steel tumbling barrels. Oblique barrels are usually preferred because of time saved in rinsing, loading, and unloading operations.

We will be very glad to arrange a demonstration of this process at your convenience at your plant.

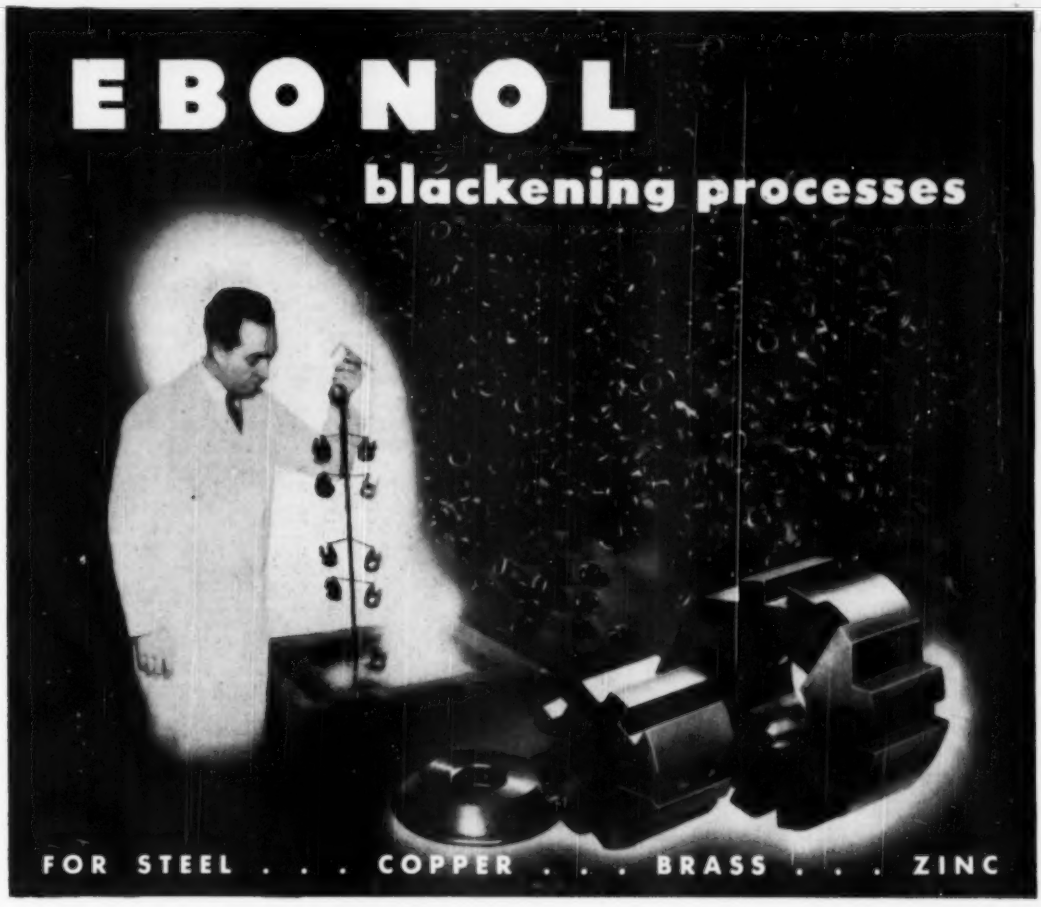
FREDERICK **GUMM** *Chemical Company Inc.*

538-542 Forest St., Kearny, N. J.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 530.

EBONOL

blackening processes



Enthone Ebonols today give new beauty, increased wearability and better functional qualities to hundreds of metal products.

The field is widely diversified: metal screens, cameras, business machines, machine tools, buttons, nameplates, dress trimmings, compacts, automobile hardware and accessories, etc.

EBONOL-C. (U. S. Patent 2,364,993) This is the best method of blackening and coloring copper and its alloys. Durable black cupric oxide is produced in a simple solution. Any metal that can be copper plated can also take this finish.

EBONOL-S. A one-bath method of blackening steel. Temperature 285 to 290° F. Simple to use and pleasant to run.

EBONOL-Z. A simple process for blackening zinc plate and zinc base diecastings. Beautiful glossy or dull finishes are achieved at low cost and trouble-free operation.

NEW TUMBLING TECHNIQUES are available for blackening and coloring. Send samples for free finishing demonstrations together with advice of experienced research chemists. *Write for new literature with procedures.*

ENTHONE INC., 442 Elm Street, New Haven, Conn.

ENTHONE

SAM IS ABOUT TO

STRIKE OIL

Slipping accidents *will* happen — unless a regular program of prevention is enforced. You can carry out such a program, quickly and at low cost, with *Wyandotte Zorball**.

Zorball is the all-purpose floor absorbent that gives an immediate anti-skid surface to stained and soaked floors. It absorbs oil, water, paint, acids and other liquids that contribute to dangerous floor conditions. Slipping and fire hazards can then be literally "swept away."

Zorball is noninflammable. Even when saturated with oil, it resists burning. It will not break down and form "mud," either. It's harmless to fabrics, wood, metals, rubber and to the skin of those who handle it.

Safety calls for Zorball. Why not call your nearest Wyandotte Representative for details?

*Wyandotte Zorball is listed by Underwriters' Laboratories, Inc.

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WYANDOTTE CHEMICALS CORPORATION
WYANDOTTE, MICHIGAN • Service Representatives in 92 Cities

6B0 FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 532.

Industry News

The Meaker Company Celebrates 50th Anniversary. It was in 1899 that the Meaker Company opened Chicago's first electrogalvanizing job shop to compete with the then supreme painted coatings for rust protection. Soon some manufacturers wanted to do their own zinc plating and the company found itself in the business of supplying their needs. Thus it developed its first Self-Sustaining Galvanizing Solution and a shaker machine to plate nuts, bolts, and other small parts in 1906; a wire-screen plating machine in 1912; a full-automatic machine for plating steel drum shells with inside anodes and synchronous-motor-driven generators in 1914; strip and flat-wire plating machines in 1916; machines for automatic plating of automobile steel rims in 1917; a general full-automatic plating machine in 1925 and the return-type fast-transfer full-automatic four years later; a high-speed strip-cleaning machine in 1933 and fast plating machines for strip a couple of years later. In the meantime the job-shop business grew and flourished.

We join with Meakers' many customers in congratulations on this anniversary. The President, Mr. Olson; the Secretary, Mr. H. A. Fosburg, and the men on the company's staff can look back on a job well done for the plating industry.

The Diversey Corporation, Chicago, leading manufacturer of cleaning compounds and other industrial chemicals, has purchased all common stock of **General Reduction Company,** Macon, Ga.

Close to 50 years old, General Reduction Company mines, processes and markets deodorizing and oil absorbent minerals. The company owns and operates a 1500-acre mine in Pike's Peak, Ga., as well as a heat-treating and processing plant in Macon. Charles E. Glasser, Treasurer of the Diversey Corporation, has been elected President of General Reduction Company. James Slocum, former General Manager, has been retained in the capacity of Vice-President. F. E. Horn is Secretary and E. A. Naughton, Treasurer.

Diversey will continue operating the company along present lines while installing additional equipment to broaden its scope.

Sulphur Products Company, Greensburg, Pa., manufacturer of Zinc-Brite,

Published monthly at 5000 N. Marvine St., Philadelphia 41, Pa. Entered as second class matter July 1, 1946, at the Post Office at Philadelphia, Pa., under Act of August 24, 1916. Copyright, 1949, by the American Electroplaters' Society, Inc. Subscriptions: Domestic and Canada, $4.00 per year, 50c per copy. Foreign, $6.00 per year, 75c per copy.

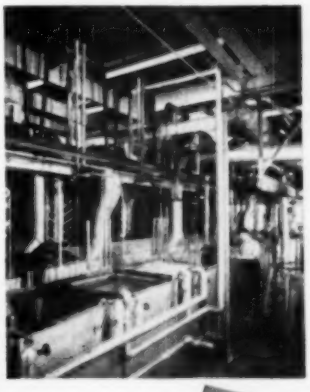
MEAKER Electroplating Machines

Tailored to Fit

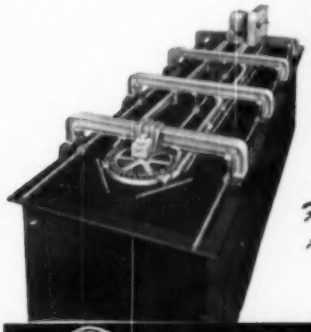
Typical Meaker Straight-A-Way Automatic Machine. This machine was built for copperplating three rows of work simultaneously. It handles 125 racks per hour that are 16 inches wide, 14 inches thick, and 70 inches long.

Meaker Special Machine designed for cleaning and silver plating small, brass contact clips. The unit is loaded at one point and the parts are carried through the operating sequence and automatically discharged into a container when completed.

Meaker Return-Type Automatic Machine for chromium plating the large variety of parts in a high-quality line of plumbing hardware.



A Meaker Semi-Automatic Machine for use in medium-output plating departments. This type equipment is used in large, job plating plants to supplement the capacity of automatic machines.



Equipment tailored to fit your requirements, making every operation in the plating sequence automatic, or as mechanized as possible, is the profitable way to handle electroplating on a production basis. This Meaker method applies equally well to departments with only moderate daily output and to the largest and heaviest automatic plating needs of the mass production plants. It offers not only a lower unit cost, but the production is increased, and a better and more uniform quality of product is assured.

Write for the Full Information. Ask for Booklet No. 148 →

50th Anniversary 1899 1949

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Now you can PLATE NEW JOBS without waiting for racks

BELKE UTILITY RACKS

Developed in collaboration with Experienced Platers to efficiently handle a tremendous variety of plating work.

The Most Complete Plating Rack Manual *Ever Produced*

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100 pages of experienced-proved information. Practical construction methods. Modern Insulations. 560 Proven Designs of Racks, Tips and Hooks. 144 illustrations of Racking Methods—showing how to rack all shapes and sizes from jewelry to bumper bars. Price $5.00 postpaid.

FIVE RACK ASSORTMENT handles 90% of all PLATING JOBS efficiently— including bright nickel and chrome

Start plating new jobs without delay: Give deliveries that get the business; Figure costs quickly and accurately — These are the things BELKE Utility Racks enable you to do.

What's more, Standardized Production gives you quality racks at a Big Saving — *about half the cost of specially designed racks.* Just read these BELKE Utility Rack Features —

Built to BELKE Quality Standards — with new Vac-Seal Removable Tip Design that gives flexibility never before available. Tips and Spines coated *independently* with BELKE Universal Plastic to withstand all cleaning and plating cycles. Spring pressure tips on all five models for copper-nickel-chrome service. Tips easily interchangeable so same spines can be used on jobs requiring different tips. Broken tips replaced in a jiffy to maintain racks at 100% capacity.

In addition, if specified, Utility Racks can be furnished unassembled — You install tips where you want them by drilling ¼" holes in spine — No tapping necessary.

Immediate Shipment—All five models in stock in 30 and 36" lengths, assembled or unassembled. Write for Bulletin 980 containing complete information or consult your BELKE Service Engineer.

Belke MANUFACTURING CO.
947 North Cicero Ave.
Chicago 51, Ill.

EVERYTHING FOR PLATING PLANTS

Industry News

Liquid Sulphur and Tin Strip, announces that **C. H. Hohner,** Box 369, Atlanta 1, Ga., has been granted exclusive distribution of the company's products in North and South Carolina, Georgia, Florida, Alabama, and the eastern half of Tennessee.

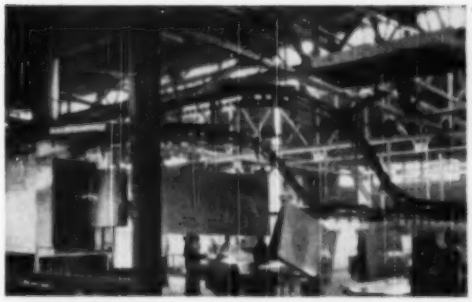
Pennsalt Fluorine Chemical Plant in Southwest Kentucky began operations in June. Under construction for approximately a year, the new $2,000,000 Calvert City Works will be devoted in its initial stages to the production of sulfuric acid and hydrofluoric acid. It will operate 24 hours a day. Plans call for future expansion that is expected to make this plant one of the largest in the Pennsalt chain.

The Sturgis Products Company, Kalamazoo, Mich., changed its name to **Roto-Finish Company** effective July 1. This change affects the name only; organization and corporate structure will remain the same. Roto-Finish has long been identified by industry as a quality mechanical finishing process.

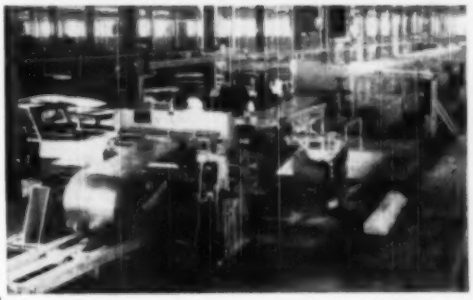
Kenneth Tator Associates, Montour Street Ext., Coraopolis, Pa., has been organized to provide industry with impartial surveys, analyses, recommendations, and supervision of corrosion control methods and materials. This firm will identify the various corrosion sources within any industrial plant or operation and draw up detailed specifications for the protection of the equipment and structures. Complete facilities for research and testing are maintained.

Kenneth Tator, well-known corrosion and registered chemical engineer, was formerly president of Industrial Lining Engineers, and still serves that company in a professional capacity. He is chairman of the Technical Committee on Protective Coatings of the National Association of Corrosion Engineers, was a pioneer in the application of vinyl plastisols to corrosion prevention, and developed many other corrosion protection methods. His experience is complemented by the experience of his associates in corrosion metallurgy, cathodic protection, and corrosion testing.

Wagner Brothers, Inc., Detroit, Mich., will be represented in the New York State area by **Don C. Blum** of Rochester. As State distributor of the company's line of plating, polishing and buffing supplies and all types of plating equipment, he will draw upon his past four years of experience as a sales and service engineer. Prior to that, Mr. Blum was in charge of plating and metal finishing for a period of six years at Rochester Products. He is well known in the field



Alodizing Reynolds *Lifetime* Aluminum sheets, building siding, and refrigerator crisper pans at the Louisville Plant of the Reynolds Metals Company.



Alodizing Reynolds *Lifetime* Aluminum coiled sheet at the McCook Illinois Plant of the Reynolds Metals Company.

FABRICATORS NOW SPECIFY

Alodized * **ALUMINUM**

FOR THE UTMOST IN PRODUCT DURABILITY AND FINISH ADHESION

Alodized aluminum has proved its value to metal fabricators through its widespread use and acceptance in industry. Now, manufacturers of aluminum are Alodizing on a huge scale right at the mill.

Alodized aluminum coil and sheets are available to fabricators everywhere—a great convenience for plants lacking facilities for properly treating aluminum, and a great cost saver from both the time and equipment standpoint.

Insist on Alodized aluminum for your own metal products.

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RUST PROOFING AND PAINT BONDING
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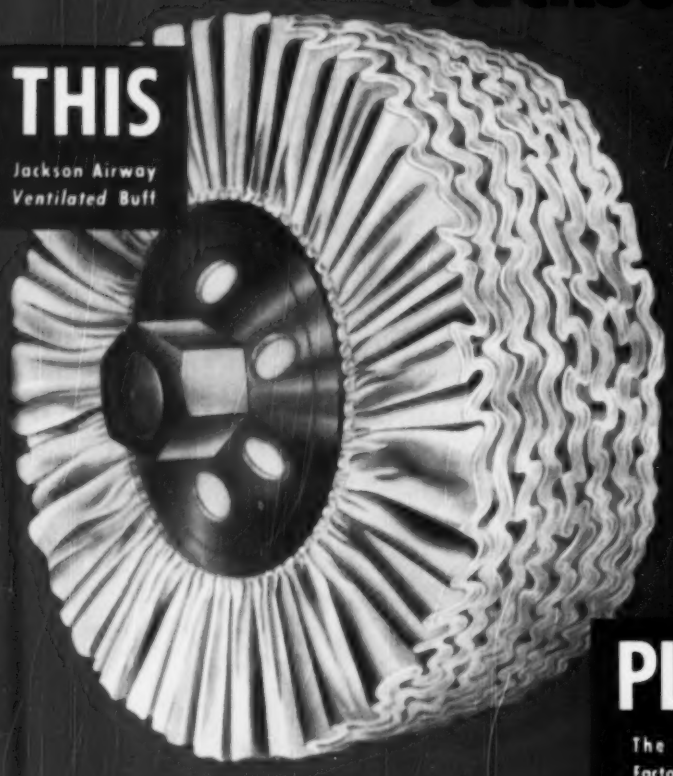
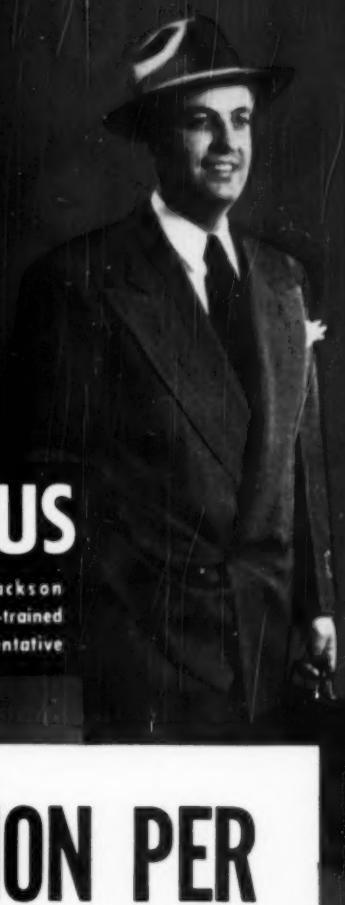
Jackson Airway the

THIS

Jackson Airway
Ventilated Buff





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The Jackson
Factory-trained
Representative

EQUALS

MORE PRODUCTION PER BUFFING WHEEL DOLLAR

Ventilated Buff is answer to quality and cost

BUY A QUALITY PRODUCT for greatest satisfaction and economy. Don't waste time and money experimenting with **"just as good"** or substitutes for **JACKSON AIRWAY *Ventilated* BUFFS.** These buffs are leading the field for maximum polishing and buffing efficiency.

Don't try to cut costs by buying cheaper buffs. **JACKSON AIRWAY *Ventilated* BUFFS** can make greater savings for you by increasing wheel-life and production . . . by producing better finishes to meet every requirement on all types of equipment.

The **JACKSON BUFF CORPORATION** has pioneered and developed the most outstanding and efficient bias type ventilated buff in the field to date.

We offer a wide range of types of buffs — and an equally wide range of prices.

Don't take quality for granted — try the **JACKSON AIRWAY *Ventilated* BUFFS** today!

WARNING NOTICE—Jackson Buff Corp. of Long Island City, N. Y., has rights in U. S. Patents Nos. Re 19,894 and 2,140,338 which have issued claims covering an air cooled buff having means for the circulation of air through the sides of the buff. Owner intends to protect all rights and may take action.

JACKSON BUFF
CORPORATION
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No Other Buffing COMPOUND Can Make this Claim . . .

Greater Cut!
Less Waste!

J. J. SIEFEN Spray Compounds have NO equal . . . nor a close substitute! Years of experience in the field have proven this to scores of satisfied users. SIEFEN Compounds definitely give a greater cut, yet are the most economical on the market to use! Regardless of your type of Buffing operation there's a SIEFEN Compound that will do your work *quicker, better* and will *reduce* your operating cost!

Greater Profits from Greater Efficiency!

Write us for full information on the SIEFEN SYSTEM—complete Spray Equipment for all Buffing and Polishing work... More production and profits!

Spray Compounds are Fast Replacing Bar Compounds!

Industry surveys have proven that 50% to 75% *less* spray compound is needed for the same work as bar compound! It eliminates fire hazard and excessive Buff wear. Modern plants are now using Spray Compounds—most use SIEFEN COMPOUNDS!

THE Siefen System
SPRAY EQUIPMENT
SPRAY COMPOUNDS
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J. J. SIEFEN CO.

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Industry News

through his membership and several offices which he has held in the Rochester Branch

Blum

of the American Electroplaters' Society. Mr. Blum's offices will remain at 322 Genesee Park Boulevard, Rochester.

AL HIRSCH

well known electroplater and chemist desires to make a new connection. Experienced in a large variety of finishing, such as automatic, still-tank and barrel plating of steel, brass and zinc, with common and precious metals, barrel finishing, electropolishing, etc. Good man with personnel. Address

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ELECTROCHEMIST

Ch.E. with eighteen years' extensive experience in most phases of electrodeposition, electroforming, metal finishing, etching, plastic plating and related fields. Wide experience in process development, installation, plant layout, consulting. Outstanding developments in bright metal and alloy gold electrodeposition. Prefer metropolitan New York area.
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SALESMEN AND JOBBERS

A comparatively new company, which has an excellent line of buffing compounds, rouge, steel and lime bars, and wishes to establish national distribution, is seeking salesmen and jobbers. This company is currently selling its products to an impressive list of manufacturers in its own area. If interested address reply to:

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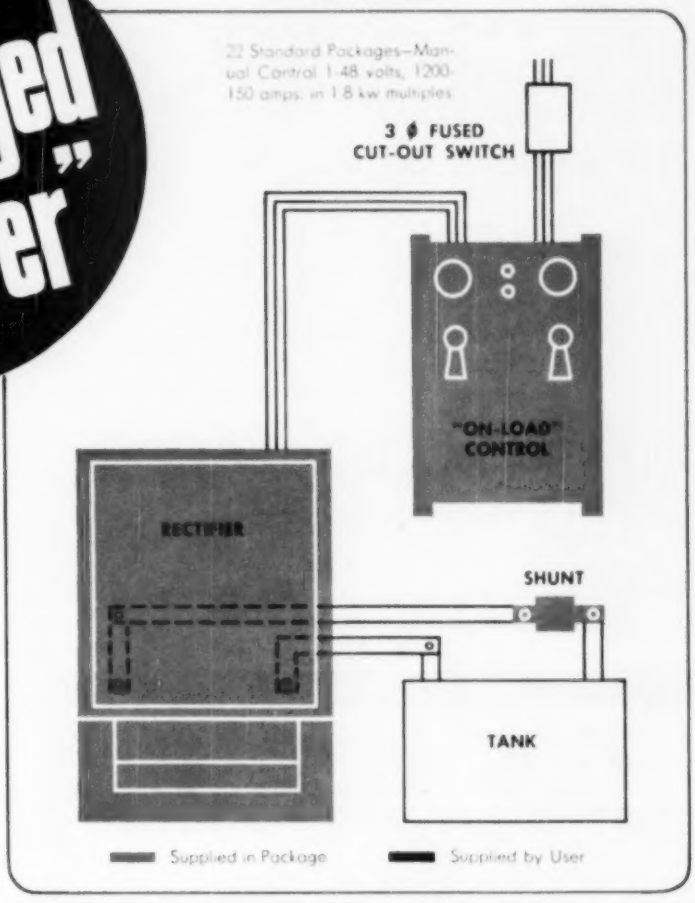
"Packaged Power"

...is economical plating power

Here's a typical "Packaged Power" Unit
The G.E. "300"



because

- "Packaged Power" is a complete power unit—rectifier and either manual or automatic control—designed to handle current for one tank—pre-engineered and tested by field applications for all types of plating anodizing and electro-polishing.
- "A Packaged Power" unit is a balanced unit—each individual part is matched to the capacity of the other parts for greatest over-all efficiency.
- "Packaged Power" units have been standardized to just a few sizes which are designed to meet all practical plating requirements. The resulting manufacturing economies of standardization are passed along to the user.
- "Packaged Power" units may be easily, quickly regrouped in parallel, series or series parallel to handle special jobs.
- "Packaged Power" units are economical to install. They require no special foundations or expensive installation accessories—rectifiers can be tier mounted under stairways or other unused waste areas.
- "Packaged Power" units have low maintenance costs as there are no moving parts other than a ventilating fan which requires only occasional lubrication.
- "Packaged Power" Rectifier stacks are copper-oxide—proved 15 percent more efficient at six volts than fan-cooled selenium at 2½ times normal rating—and, comparatively, even more efficient at lower voltages.

For complete information, send for the free booklet "Copper-Oxide Rectifiers and Controls" GEA-5247. Apparatus Department, General Electric Company, Schenectady 5, N. Y.

GENERAL ELECTRIC

CLEAN-RITE
All-Purpose CLEANERS

ELECTROPLATING AND POLISHING EQUIPMENT

PLATING RACKS
BUFFS
GENERAL SUPPLIES

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PLATING ROOM SERVICE

Let us help you solve your problems.
Take advantage of our practical experience.

JACOB HAY COMPANY
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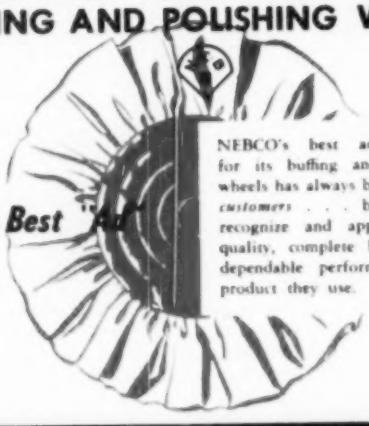
NEBCO

BUFFING AND POLISHING WHEELS



Our Best "Ad"

NEBCO's best advertisement for its buffing and polishing wheels has always been *satisfied customers* . . . because they recognize and appreciate top quality, complete honesty and dependable performance in a product they use.

NEW ENGLAND BUFF COMPANY

493 C Street, Boston 10, Massachusetts
7338 Woodward Avenue, Detroit 2, Michigan

Personals

R. T. Riggs is now Sales Manager for the North Chicago plant of Atlas Powder Company, manufacturer of Zapon finishing materials. He was formerly with Standard Varnish Company in New York City and with Pittsburgh Plate Glass Company in the Midwestern States.

Beitzel

George B. Beitzel was elected President of Pennsylvania Salt Manufacturing Company on the eve of its 100th anniversary year. The new chief executive joined the company 19 years ago and since January 1 has served as Executive Vice-President. **Leonard T. Beale**, president for the last 20 years, will continue with the company as Chairman of the Board.

The Board also elected **William P. Drake** Vice-President in charge of Sales, and **William F. Mitchell** Vice-President in charge of Manufacturing. Mr. Drake, formerly assistant Vice-President, Sales, assumes the position left vacant when Mr. Beitzel became Executive Vice-President. Mr. Mitchell, assistant Vice-President, Manufacturing, succeeds **Y. F. Hardcastle**, who retires from active participation in the chemical company's operation but who remains as a member of the board.

A native Philadelphian—as is his predecessor—Mr. Beitzel served with the 79th Division during World War I. For 12 years he was associated with John T. Lewis & Brothers Company before joining Pennsalt as Sales Manager. He was elected Vice-President in charge of Sales in 1942.

Mr. Beale first became associated with Pennsalt in September, 1923 when he was elected to the Board of Directors while serving as Vice-President of John T. Lewis & Brothers Company. Five years later he was elected President of Pennsalt.

Mr. Drake joined the company in 1934 to take a two-year student training course. In 1936 he became Sales Service Manager and three years later was named Manager of the Pennsalt Cleaners Division. He became Manager of Sales in 1943 and was named Assistant Vice-President, Sales, in 1947.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 538.

He can SHOW as well as tell you

what he can do for you . . .

Because NORTHWEST products have a distinctive appearance, our men have always carried samples. Now they are equipped with a case in which products in general use are carried together with equipment for their control. There are liquids and powders — some for use individually, others in combination to get the correct pH for the type of soil to be removed . . . NORTHWEST men are thoroughly experienced in all phases of cleaning and surface preparation. They make the correct recommendation as to which product or products to use — handle their installation and set up their control . . . Ask the NORTHWEST man to SHOW you as well as tell you what he can do for you . . . .

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 539.

Personals

Mr. Mitchell became a Technical Service Engineer for Pennsalt in 1936. Later he was named Assistant to the Works Manager at the company's Philadelphia office, and became Plant Superintendent at Wyandotte, Mich., in January, 1945. Three years later he was made Assistant Vice-President of Manufacturing.

The retiring Vice-President, Mr. Hardcastle, is the oldest Pennsalt officer in points of service. Beginning as a draftsman in the engineering department at Wyandotte in 1909, Mr. Hardcastle became Supervisor of electrolytic operations there a year later, and in 1915 was made Superintendent at Wyandotte. In 1928 he was elected Vice-President, remaining in Wyandotte until 1932, when he moved to the executive offices here. He became a director of the company in 1948.

H. J. Fink has been appointed to direct sales and service for Binks Manufacturing Company, manufacturers of industrial spray-finishing equipment and systems, in Colorado, Kansas, Nebraska, Wyoming, Montana and New Mexico, from headquarters at 346 Grant Street, Longmont, Colorado, a Denver suburb. **C. J. Rood** has been made Manager of the Company's Indiana branch office at 117 E. Michigan Avenue, in Indianapolis, Ind. **M. B. Scully** will handle sales and service in northern Illinois and the State of Iowa, with headquarters at 1028 S. Euclid Avenue, Princeton, Ill. **E. J. Cremer** has the same position in southern Illinois and the State of Missouri. He will have his office at 705 Olive Street, St. Louis, Mo. **B. R. Fulton** will be in charge of the Binks new and enlarged Ohio direct-factory sales and service branch at 1231 W. Ninth Street, in Cleveland, Ohio. **Harvey J. Dueno** has taken on the same responsibility in Milwaukee, Wis., headquarters for Wisconsin, peninsular Michigan, Minnesota, North Dakota, and South Dakota. This office recently moved into larger quarters at 1123 N. Jackson Street.

Joseph Dahle, formerly Research Director of Synco Chemical Corporation and Aspinook Corporation, has been appointed Director of Research for the Atlas Mineral Products Company.

George J. Martin is now Special Salesstaff Assistant with Diamond Alkali Company, Cleveland, and will work under the direction of Charles E. Grant, Manager of Chromium Chemical Sales. Since 1947 he has been with Carl Anthodz, Inc., Newark, N. J., in an executive capacity. During the previous 18 years he was associated with Sandoz Chemical Works, Inc., New York City and was manager of the company's leather department at the time he left. A native New Yorker, 37, Martin attended New York University.

Edward L. Lockman has been appointed Manager of tank lining and roll covering sales for United States Rubber Company. A graduate of Massachusetts Institute of Technology, he joined U. S. Rubber in August, 1934, as a salesman in New York. In 1938 he became Assistant Sales Manager of roll covering and tank lining. From 1942 to 1945 he served in the U. S. Army, attaining the rank of captain. He returned to his former position in December, 1945.

Dr. Michael A. Streicher has recently joined the Engineering Research Laboratory, E. I. du Pont de Nemours & Company, Wilmington, Del. He was formerly with the Corrosion Research Laboratory, Bethlehem, Pa.

Dr. Harold J. Wiesner some time ago joined the Bendix Products Division, Bendix Aviation Corporation, South Bend, Ind., as Chemist in the Factory Labora-

NO SHUT DOWN

to carbon treat solution with . . .

SPARKLER *horizontal plate* FILTERS

Only a few minutes are required to lift out the horizontal plate assembly in a Sparkler Filter and drop in a clean set of filter plates and production is under way without appreciable interruption.

Tanks are given a carbon treatment without shutting down production in the battery installation shown here. One or two filters are cut out of the line, drained, cleaned and dressed with clean filter papers. The proper amount of carbon is mixed with water in a stand-by tank and recirculated through the filters thus depositing the carbon on the plates in a cake of uniform thickness and density. The solution requiring a carbon treatment is then circulated through the carbon beds giving the plating solution the carbon treatment without contaminating the tank or stopping plating operations.

Sparkler Horizontal Plate filters give absolutely sharp filtration at all stages of the cycle.

A battery of 18 Sparkler Filters in one of the largest bright nickel plating plants in the world.

SPARKLER horizontal plate FILTERS

SPARKLER MANUFACTURING CO., MUNDELEIN, ILLINOIS

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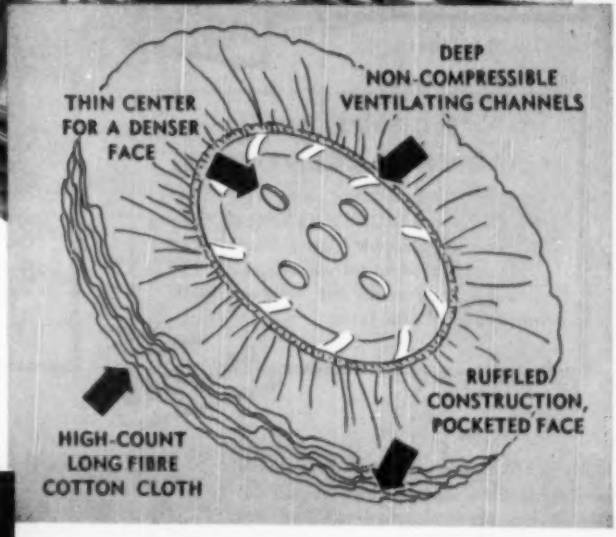
Longer Life - Greater Production

with CODMAN *BUFFS


THIN CENTER FOR A DENSER FACE
DEEP NON-COMPRESSIBLE VENTILATING CHANNELS
RUFFLED CONSTRUCTION, POCKETED FACE
HIGH-COUNT LONG FIBRE COTTON CLOTH

* CODMAN'S
VENTILATED, NON-FRAY BUFF

Is Made Under Patent Numbers
2,027,863; 2,094,650; 1,573,961.
Re. 19,894; 2,140,208.
Other Patents Pending.

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COMPANY
ROCKLAND · MASSACHUSETTS

For Over 50 Years the Greatest Name in Buffs

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Personals

tory. He was formerly Research Chemist with C. G. Conn, Ltd., Elkhart, Ind. Dr. Wiesner is active in the research organization of the American Electroplaters' Society and a member of its St. Joseph Valley Branch.

Joseph H. Harris, formerly with R. N. Nason Company and the Pittsburgh Plate Glass Company, has been appointed Manager of Customers Service at the North Chicago, Ill., branch of the Industrial Finish Department, Atlas Powder Company. He attended Northwestern University and Michigan State College.

P. E. Wilson has been appointed representative for water-pipe jointing-material sales in the New York area by the Atlas Mineral Products Company.

H. J. Butterill, formerly Corrosion Engineer with the International Nickel Company in Toronto, is now Chief Design Engineer with the Armament Design and Experimental Establishment of the Canadian Department of National Defence, Quebec, P. Q., Canada. Mr. Butterill is a member of the Toronto Branch of the American Electroplaters' Society.

Brossart

Jack F. Brossart, until recently General Sales Manager of Industrial Filter and Pump Manufacturing Company, Chicago, Ill., has been appointed Pacific Coast Manager of the company. **Harold W. Faint,** who has been with the company

Faint

since 1945 and recently Manager of the Ion Exchange Department, has been appointed General Sales Manager, succeeding Mr. Brossart. Both are active members of the American Electroplaters' Society.

Walter R. Coley, a Vice-President of Leeds & Northrup Company, manufacturers of precision electrical measuring instruments and automatic controls, has retired after 43 years' service with the firm. A native of Philadelphia, he received his education at Central High School and in evening classes at Drexel Institute of Technology. He joined Leeds & Northrup in May, 1906, seven years after the founding of the company, as an instrument maker in the galvanometer section of the laboratory.

George A. Buck, Jr., formerly Secretary-Treasurer of Ideal Plating Corporation, Elkhart, Ind., was recently elected President of the company. He is a very active member of the St. Joseph Valley Branch of the American Electroplaters' Society.

OBITUARIES

†**Walter Amerikaner,** partner in the firm of Belkyo Plating, New York City, passed away on Thursday, April 28 after a short illness. He had been associated with the firm for over five years. He was known throughout the trade as a tireless worker, an honest and fair business man, and an engaging personality. He leaves a widow, Mrs. Helen Amerikaner.

†**Albert L. Plumacher** passed away on April 26. He was, for a long time engaged in the operations of R. Plumacher & Sons, New York City. He leaves a widow, Mrs. Norah Plumacher, daughter Dolores Virginia Plumacher, mother Mrs. Anna Plumacher, brother Walter Plumacher, and sister Mrs. Gertrude Schreiber.

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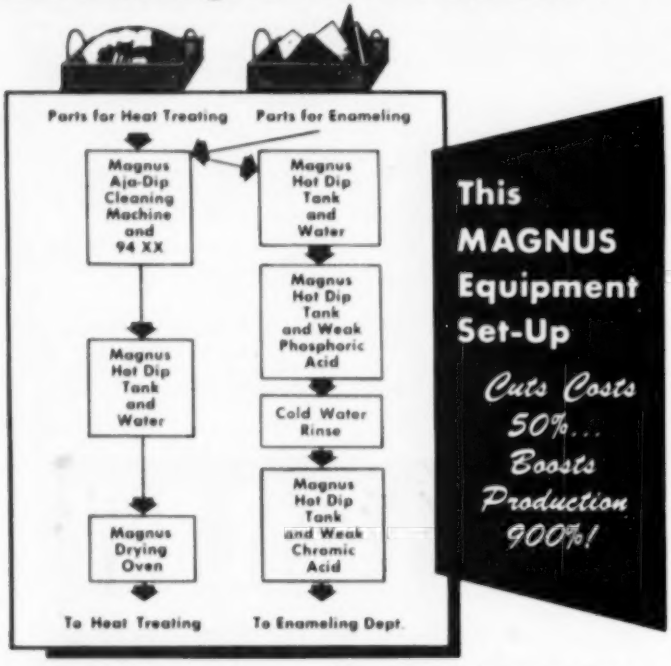
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MAGNUS Method	See flow chart above.
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The Mailbox

Subject: Barrel Gold Plating

DEAR SIR:

I have read with considerable interest Dr. Parker's informative paper in the May issue and would like to discuss a few points in it.

A reference to barrel gold plating is my article in the March, 1941 issue of Products Finishing, pp. 28-40.

Dr. Parker states, "Thus copper must be occluded in the gold precipitate in some fashion to account for the off shade". It seems to me that "occluded" is not the word to describe the reason for off-colored gold deposits on brass from an immersion gold solution that is badly contaminated with copper. As I have pointed out in the October, 1941 issue of Products Finishing, p. 84, they are the result of periodic deposition or codeposition of copper with the gold.

What happens in most practical cases where immersion deposits are applied is that the gold concentration is permitted to decrease as the copper concentration increases because there is no replenishment or insufficient replenishment. Soon a point is reached where the copper ions outnumber the gold ions at the interface between the brass and the gilding solution. The gold ions in contact with the surface are neutralized and precipitated on the brass in a very thin porous layer with the formation of an active couple between the gold and the brass. Because the gold ions are now momentarily depleted in the vicinity of the work, copper ions are discharged and precipitated, or plated out. Thus there takes place periodic deposition or codeposition of the copper with the gold, depending on conditions at the interface. It is common knowledge that rapid agitation of the work in a contaminated immersion-gold solution produces lighter shades of gold than when the work is held stationary and that if the gold content of such a solution is increased and the work is agitated it is still possible to get a good gold color even though the copper content is relatively high. In barrel plating the same thing holds except that here the copper plates out because of an external electromotive force and not because of an internal electromotive force as in immersion gilding.

Barrel gold plating and barrel gold-alloy plating have been successfully practiced for the past ten years or so, if not longer. There are today in New York alone several commercial firms that do gold and gold-alloy barrel plating in huge volumes daily, in fact they specialize in just this alone. The idea of replenishing gold plating baths, even for decorative purposes, was preached by me many years

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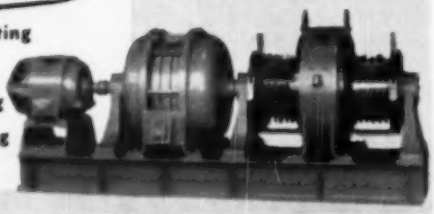

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The Mailbox

ago and I am glad to learn that it is now being done on a large scale.

When it comes to analysis of gold plating solutions, I still prefer the simple gravimetric method of precipitation with sulfuric acid (Anal. Chem. 1938, 641) over the considerably more involved arsenite-iodide method or the colorimetric method recommended by Nell. There is need for a really simple gold-analysis method that any plater can apply without trouble; unfortunately it has not yet been published.

Sincerely yours,
JOSEPH B. KUSHNER

DEAR SIR:

The production of dark off-shade deposits from an immersion gold solution of low gold and high copper content as described by Kushner is a natural and logical one, but my remarks to such deposits from immersion gold solutions were for solutions in which the gold content had been maintained at the proper level.

The question of occluded or codeposited copper is an academic one. A copper solution made up in the same manner as a gold solution will not deposit copper on a copper or brass article. However, if gold is then added, deposition will take place and both metals will be present in the deposit. Whether the gold "drags down" (occludes) the copper or a trimetal cell is set up which results in the deposition of gold-copper alloy plate is only a matter of speculation and does not lead to an answer on how to prevent the deposition of copper.

As to Mr. Kushner's reference to his article on barrel gold, I have not seen that particular issue of Products Finishing and would appreciate receiving a copy of his whole series on gold.

There was no intention to infer that nobody was successfully barrel plating gold or gold alloys, only that in the field generally there was little or no information available on this subject.

I quite agree with his desire for a simple analytical procedure for gold. Too many times have I seen aliquot portions of a plating solution sent to several places for analysis and no two agree. The differences were almost always large, 10 to 50 per cent. In my experience it has always been impossible to convince a plating department to use a gravimetric method, whereas the arsenite method is being used without any trouble in quite a few places. It is, however, a long way from being a best method.

Very truly yours,
EDWARD A. PARKER

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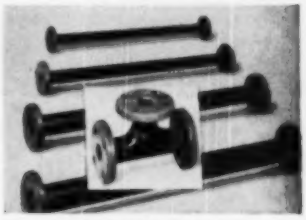

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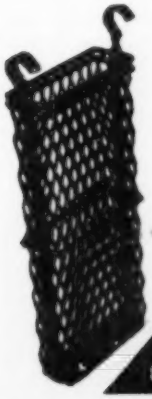

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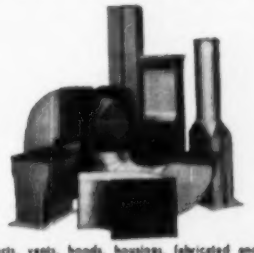

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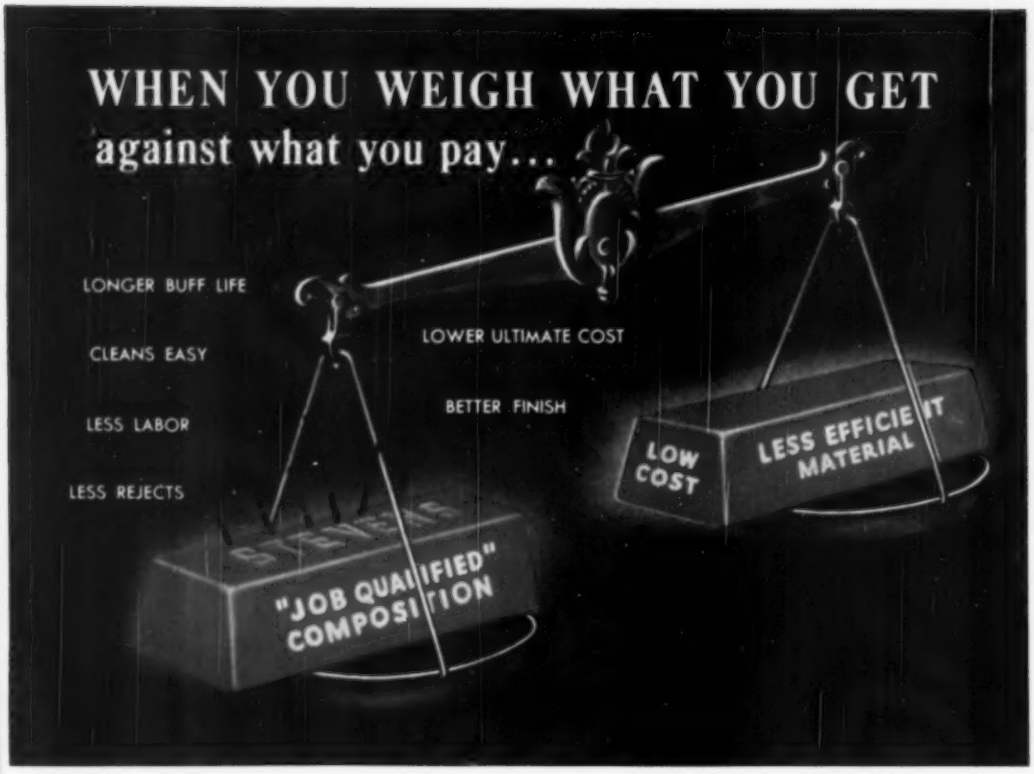

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The cost of buffing and polishing materials is an important factor in metal finishing and it would be wise to remember that very often the use of low-priced material may prove to be expensive in the long run. Savings involved in buying a barrel of "cheaper" composition may very quickly be wiped out by losses due to increased buff wear, rejects, extra cleaning costs, lost man hours—to say nothing of unbalanced output schedules.

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METAL FINISHING EQUIPMENT AND SUPPLIES DIVISION

The cover picture, which shows how current is transmitted to steel strip moving at a speed of up to 1500 feet per minute during tin plating, is part of the story on page 712 dealing with manufacture of electrolytic tin plate by Weirton Steel Company.

PLATING is abstracted regularly in Chemical Abstracts, Engineering Index, Technical Data Digest and Bulletin Analytique.

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plating

JULY 1949 VOL. 36 NO. 7

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Editorial

Job Satisfaction

IN THE APRIL ISSUE we touched upon establishment of good labor relations as a factor in cost reduction.

Since a knowledge of the workers' desires is a necessary requisite for that understanding which alone makes good labor relations possible, it is important to know that management's and foremen's ideas of what workers want are often completely wrong. Such, at least, is the result of a recent survey by a group of large employers.

It lists, for men, in order of decreasing importance, (1) security in the job, (2) supervisors who know their business, (3) opportunity for advancement, (4) adequate wages, (5) employee benefits, such as insurance and health programs, (6) factual information about how well they, the firm, and the industry are doing, (7) suitable vacations and holidays, (8) a share in the business profits in the form of cash or pension, (9) a job which fits the individual, and (10) promotion within the company.

Women look for interesting work or good working conditions before job security.

It is striking that wages, which management and foremen thought, and many labor leaders insist, to be of paramount importance, are only fourth on the male workers' list.

Praise, credit, and companionship make for that feeling of belonging which is necessary in the job as well as in all other human relationships. They certainly are the beginning of job security and hence also of good labor relations.

Gustaf Soderberg

PLATING OF PRESSED METAL POWDER PARTS

— a preliminary study —

A. K. GRAHAM*, H. L. PINKERTON*, E. A. ANDERSON†, and C. E. REINHARD†

PRESSED METAL powder parts are relative newcomers to the wide list of materials to which plated coatings are applied. Like all other forms of material, pressed metal powder parts are amenable, in general, to normal plating procedures but have a few individual characteristics which must be considered in developing a suitable cycle of plating operations.

The present paper reports the results of an exploratory study of the problems involved. The work was initiated by the New Jersey Zinc Company, a producer of metal powders. The object of the program was twofold: to determine the extent of the problem, and in an exploratory fashion to develop and evaluate plating techniques which would help overcome any indicated difficulties. From this work and other available information, it has been possible to formulate tentative procedures which may be useful to the plater in his first attempts to plate this new material.

Present Metal Powder Parts

The following brief description of the procedures used in making pressed metal powder parts may assist the reader in understanding the problem. As the name implies, these parts are produced by compressing fine metal powders in a suitable die following which the parts are sintered in a special atmosphere at a selected temperature. While there are many compositions of metal powder available commercially, the present work was carried out with an 85 copper-15 zinc brass powder, and the descriptions of procedure given here are for this material. This powder as made available to the fabricator contains a range of particle sizes from about 100 to finer than 325 mesh, with the finer sizes somewhat predominant.

In commercial operation, a small amount of a suitable lubricant, such as zinc stearate, is added to the powder to minimize friction between the so-called compact and the die. The influence of any small amount of stearate not driven off in the sintering operation is not yet known, but presumably any which is sufficiently near the surface to be of importance might be expected to be removed in the cleaning operation. The powder is metered into the die and is compacted with a pressure of from 30 to 50 tons per square inch. In some cases, pressures as low as 20 tons per square inch are encountered.

At this stage, the so-called green compacts are weak, brittle, and porous. Maximum strength and reduced porosity are obtained by sintering. For the present brass, a temperature of 900° C (1652° F) for $\frac{1}{2}$ hour at temperature seems optimum, although small deviations are permissible. The sintering atmosphere may be cracked gas or dissociated ammonia.

The final sintered compact is strong and dense to all practical intents and purposes but will nevertheless contain some porosity throughout the body and in the surface; it is with the latter that the plater must reckon. This porosity may be reduced to a minimum and the surface brought to a higher degree of perfection if the parts are re-pressed or coined after the sintering step. The added element of cost can only be justified by some equal or greater saving in the plating operation resulting from the improved surfaces, a point which will be discussed in greater detail later in the paper.

The surface pores with which the plater will be concerned normally range from 1 to 5 mils in diameter and are of similar depth. In some cases, the depth is greater and the pore becomes tortuous. Typical structures are seen in Figs. 1 and 2.

Experimental Specimens

The standard parts used in most of this work were tensile test specimens produced experimentally by the New Jersey Zinc Company. They were of 85–15 brass alloy, mixed with 0.5 per cent of zinc stearate, compacted at 40 tons per square inch, and sintered for 30 minutes in dry hydrogen at 900° C, yielding compacts with the following mechanical properties:

Tensile strength, psi.	26,000 to 33,000 (30,000 average)
% elongation in 1 inch.	11 to 20 (16 average)
Brinell hardness	43 to 50 (46 average)

The specimens were $1\frac{1}{2}$ inches long, 0.10 inch thick, 0.53 inch wide at the grips, and 0.25 inch wide in the gage section, giving approximately 2 square inches of apparent plating area. That the actual plating area was much larger due to voids and surface roughness

*Graham, Crowley and Associates, Inc., Jenkintown, Pa.
†Technical Department, The New Jersey Zinc Company (of Pa.), Palmerton, Pa.

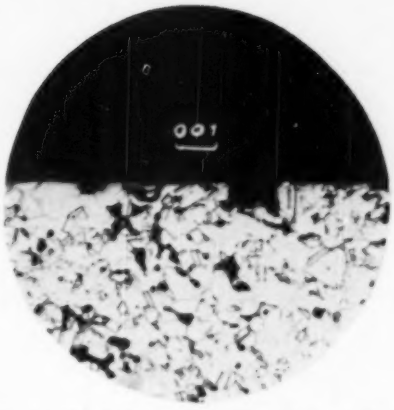


Fig. 1. Typical cross-section structure of 85–15 brass pressed-metal-powder part. 250X

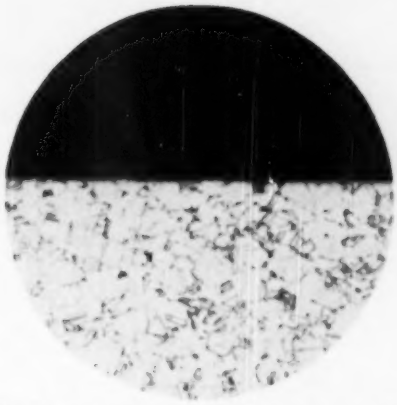


Fig. 2. Typical cross-section structure of coined 85–15 brass pressed-metal-powder part. 250X

was demonstrated when attempting to plate to a desired thickness.

The 40 tons per square inch compacting pressure was chosen as representative of what would frequently be met with in actual practice. While higher pressures can be used to produce denser compacts, it was the purpose to study average rather than extreme conditions. Actually, later tests with variations in compacting procedure showed that these were not important variables. In fact, the slightly denser compacts were somewhat more troublesome to process successfully due probably to the greater difficulty of cleaning and rinsing the relatively smaller pores.

Drag-Out

Aside from the problem of producing a deposit that is commercially acceptable from appearance and durability viewpoints, it is evident that the transfer of metal-powder parts from one plating tank to another could very quickly induce harmful contamination. Precautions involving thorough rinsing and neutralization obviously are necessary to avoid serious solution maintenance difficulties.

In the very first tests with unbuffed parts, the final hot rinse began to streak the deposits after only 10 or 15 specimens had been processed in 800 ml water. Prolonged cold water rinsing did not prevent this. Several cycles of alternate hot and cold rinsing prolonged the life of the final rinse very materially. A suitable weak neutralizing dip prior to hot-and-cold rinsing was introduced to aid in preventing spotting-out and also was effective in reducing the drag-over of objectionable salts into the final rinse. The exact nature of this neutralizing dip will, of course, be determined by the chemical character of the solution being neutralized and will be discussed further under Spotting-Out. A test (see below under Mechanical Finishing) of the surface porosity resulting after various mechanical surface treatments showed that the drag-out with a standard untreated compact may be as much as ten times that of a similar piece treated to reduce surface porosity and smooth the surface. In the cleaning cycle prior to plating, therefore, hot-and-cold rinsing should uniformly be substituted for the usual cold rinsing and a neutralization treatment suitable for the process should be included before the preplating rinse. Care should be taken to avoid using solutions in the cleaning and pickling cycle which contain materials deleterious to the plating bath such as a hydrochloric acid dip prior to acid copper plating.

It should be borne in mind that these statements are made from the point of view only of drag-out in commercial operations. It is perfectly possible to clean in the usual type of cycle without extra precautions and produce a plate of normal appearance. The consequences of failure to observe precautions will show up only when a costly solution has become badly contaminated or even ruined. Granted only that the cleaning is adequate, extra precautions observed in the cleaning cycle do not seem to affect the performance of the deposit*. This depends more on the mechanical condition of the surface and on the nature of treatments after plating. No unusual cleaning procedures were found to be required, but it is necessary to use a good anodic alkali cleaning in the cycle if the pores are to be cleaned effectively.

Mechanical Finishing

The natural reaction on being asked to plate a porous object is to attempt to close the pores. One

*This has not been established, however, and the possibility should not be overlooked that poor rinsing practice might degrade service performance.

TABLE I. EFFECT OF MECHANICAL TREATMENTS ON THE SURFACE POROSITY
(Based upon drag-out test)

Sample No.	Description of Specimen	No. of Cycles (corrected) to Discharge Color with					Porosity No. ml sq.ft.-cycle
		2	4	6	8	10	
		ml 0.108-N NaOH in test tube					
1	Standard	7	13	22	28.5	35.5	0.72
2	Re-pressed	23.5	49.5				0.21
3	Ball-burnished	34	69				0.15
4	Buffed* copper plate	47					0.11
5	Buffed* base metal, buffed* copper plate	46					0.11
6	Buffed rolled brass	49					0.10

*With greaseless composition.

obvious method of accomplishing this is to use an impregnating material, but in the present case this did not seem practical from a cost standpoint. Another possibility is to flow the surface by some form of mechanical working. It was shown in the laboratory that hand-burnishing was effective in reducing the number and size of pores on the surface as observed under the microscope and as evidenced by increased resistance to spotting-out. Other methods of working the surface would include re-pressing the compact, ball burnishing, and polishing or buffing. To obtain some quantitative data on the relative effectiveness of such treatments, the following drag-out test was devised.

In the test each compact was subjected to 80 cycles, each cycle consisting of the following steps:

(1) Immerse 15 seconds in 20 per cent by volume of concentrated hydrochloric acid.
(2) Immerse 15 seconds in 20 per cent by volume of concentrated hydrochloric acid with wetting agent present.
(3) Two quick thrusts into cold running water (about 1 second total).
(4) Immerse 30 seconds in test tube of standard alkali.
(5) Thorough cold water rinse (1 minute).

The first acid dip was used to minimize dilution of the second which had been standardized at 2.45 N. The wetting agent was used in the second acid to increase penetration of the pores. The very brief rinse was expected to remove most of the surface acid without substantial loss of acid in the pores. The test tubes were filled with a solution containing 2 ml of 0.1-N sodium hydroxide with phenolphthalein indicator. When the indicator color had been discharged by the acid carried over, the number of cycles was noted, another 2 ml of standard alkali was added, and the test continued. At the end of 80 cycles, the second acid dip was observed to have been diluted to 2.12 N. On the assumption that this dilution was directly proportional to the number of cycles employed, the observed number of cycles for each specimen was corrected accordingly. The volume carried over per cycle was calculated and expressed as millimeters per square foot. The results are shown in Table I where it can be seen that buffing, ball burnishing, and re-pressing are, in descending order, quite effective in reducing drag-over.

It is evident from Table I that a thorough buffing job on a copper primary coating can reduce the drag-over problem nearly to the level of that of buffed rolled brass. This might be taken to imply that the extra rinsing precautions discussed in this paper would not be required under these conditions. It must be remembered, however, that not all surfaces of a plated part necessarily are buffed and that there will be some variability in the porosity of commercial parts. It seems likely, therefore, that pressed metal powder parts will require some extra care in rinsing as the general case.

Where the price advantage in using a metal powder article is small, the operation of re-pressing may be impractical, but where feasible, it may be used to effect a decided improvement in surface finish and appearance as well as to reduce porosity. This point will be discussed further at a later place in the paper.

On metal-powder compacts, buffing and ball burnishing present some special problems. In an exploratory program of this kind, it was not possible to in-

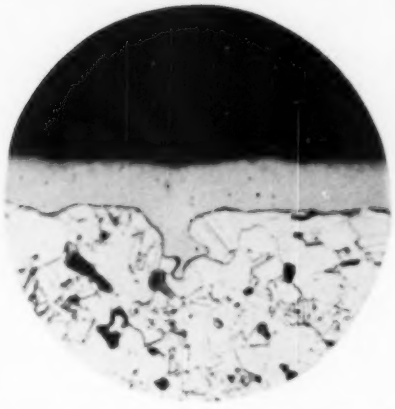


Fig. 3. Nickel plated brass pressed-metal-powder part. Note how nickel has filled the clean pore. 500X

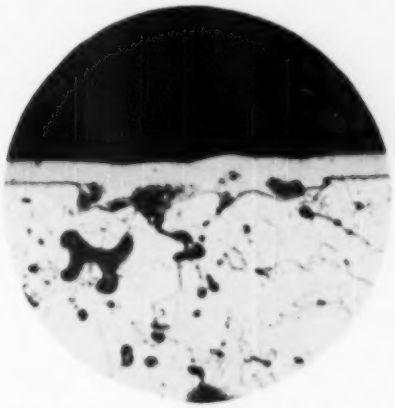


Fig. 4. Same as Fig. 1. Note dirt in pore under nickel and defect in plate. 500X

vestigate these thoroughly, but some pertinent observations may be made.

In ball burnishing, it will take longer to produce an acceptable finish on a compacted article than on wrought metal and a higher luster is difficult, if not impossible, to attain. Our experience admittedly has been very limited, but in our observation, ball burnishing on a brass-powder compact produces an orange-peel surface. On a certain number of the pieces, there were definite peen marks from the balls. In these tests, this number was uniformly about 4-5 per cent of the lots, some of the pieces showing only a few marks while a few were practically covered with them. The authors cannot state with certainty whether these marks were associated with an unusual degree of porosity in the compact or not.

In the tests, the compacts were rolled 90 minutes with small steel balls in a suitable burnishing solution in an hexagonal wood-lined barrel operated at about 15 rpm and tilted about 20 degrees from the horizontal. Varying the ball load from 15 to 5 times the weight of compacts did not change the results but only the time in which maximum luster was obtained. Other variables investigated likewise were without effect. These included compacting pressures of 30 and 50 tons per square inch, a sintering temperature of 875° C, 0.3 and 0.7 per cent zinc stearate lubricant in the compact, and a compact thickness of 0.25 inch. It may be mentioned here that these same variables also showed little detectable effect on the tendency of spotting-out after plating.

As would be expected in buffing a surface such as is considered here, more work is required to produce a desired luster than on a rolled surface. The type of wheel and compound used also is more important. The greaseless type of compound has shown the best results, but no attempt has been made to explore all of the possibilities. Certain grease compounds render the compact extremely difficult, almost impossible, to clean. The result of failure to remove buffing compound from pores is shown in Figs. 3 and 4.

Much further work will be needed before the best buffing practices for compacts are known. For the moment, however, the choice of greaseless compounds seems to be indicated. The first operation should be essentially a mild polish, otherwise a dragged or orange-peel surface results. The second step would then be essentially a fine buffing operation with the abrasive chosen to give the finest surface texture. Maximum luster cannot be obtained with greaseless compounds, and a final dry lime coloring operation may be needed. It should be pointed out, however, that this latter step was not studied in the present work and that any influence of the lime compound on the results is not known.

Where the plating is to be nickel-chromium for outdoor or other heavy duty service, difficulty may be encountered in obtaining a satisfactory final appearance. The best surfaces were obtained only by a sequence of operations involving buffing of the compact and plating with a heavy (1 mil) copper deposit which was subsequently buffed before nickel plating. This procedure was necessitated by the appearance of blemishes in the surface which could not be remove by buffing alone but required the filling in with copper.

It seems possible that re-pressed surfaces might be sufficiently perfect to permit elimination of the copper plating and copper buffing steps. Undoubtedly, there will be instances where the cost of re-pressing will be less than the cost of copper plating and buffing. However, there may well be other instances where the reverse is true. As the powder metal industry advances, it is to be expected that methods will be developed for producing improved surfaces and that more and more compacts can be plated by the less expensive nickel direct procedure. In the final analysis,

the competitive position of plated pressed-metal-powder parts relative to plated wrought-metal parts will depend upon the overall costs of the finished articles and not on the individual part and plating costs.

Spotting-Out

Spotting-out is a staining resulting from the interaction of the deposit surface with material exuding from the pores of the article or the coating. Relatively inert metals and those which do not readily form oxides or sulfides such as nickel and tin are not particularly susceptible to spotting-out when applied as coatings, even on porous objects. Copper, on the other hand, is very sensitive to this type of failure and for this reason was chosen for this investigation. Since heat and humidity accelerate spotting-out, it was decided to test the deposits by exposure to 100 per cent relative humidity at 100° F. Under these conditions, spotting was evident in less than one hour on a compact copper plated in the conventional manner.

Cyanide-copper deposits stained sooner and more severely than those from an acid copper bath. It proved more difficult, however, to eliminate staining on the acid deposit, and this was therefore used in subsequent work to judge the efficacy of our procedures. It was possible eventually to produce a finish from an acid copper bath that showed no staining even under the microscope after 240 hours' exposure. This was accomplished only with mechanically working the original surface in some fashion. When this was not done and reliance was placed entirely on various other expedients to be described, protection was afforded for about 20 hours at best. These statements apply only to unlacquered finishes; lacquering, of course, extended the protection to a degree corresponding to the properties of the lacquer film.

The special procedures employed to reduce spotting-out were all devised with the hope of having the pores of the object at the end of the process as free as possible from objectionable substances. This goal can be approached (1) by diluting the objectionable substances, (2) by replacing them with less harmful materials, (3) by attempting to remove everything from the pores, and (4) by success in filling the pores with electrodeposited metal. This latter point will be discussed in more detail later in the paper.

(1) It is obvious if the pores are first filled with water that any other substance will have to enter by the slow process of diffusion and hence will be more dilute than in the absence of this water. At first glance this seems advantageous, but to the extent that it is effective, the cleaning in the pores must necessarily be that much poorer and this consideration would outweigh any other. Actually, in the spotting-out tests this and all other variants in the cleaning cycle appeared to be without effect in so far as staining of the plate was concerned.

If a strong current could be passed through pure water, electrorinsing, as it might be called, should provide the most efficient rinse possible because of the vigorous local agitation that it would supply. To approach this a solution of 1 gram per liter of sodium metasilicate was used cathodically at 9 volts giving a current density of about 5 amperes per square foot. This procedure was helpful in preventing staining. When 1 gram per liter of chromic acid was used in this fashion, it was very effective but at least some of this was due to passivation of the copper by the chromate ion.

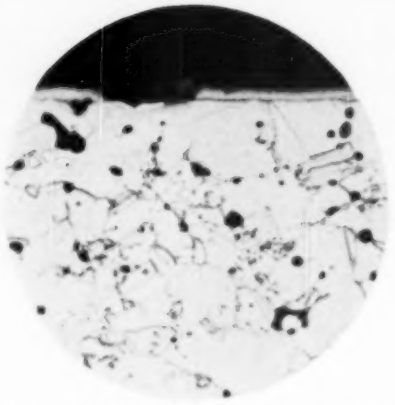


Fig. 5. Nickel plate on unbuffed specimen after 11 weeks' exposure. Note corrosion of nickel at perforation. 500X

The effectiveness of alternate hot-and-cold rinsing has been mentioned. Sometimes this is explained by ascribing the improved rinsing to a pumping action due to volume change, but this is an inadequate explanation. A cavity in a brass surface would change about 4 per cent in volume between boiling and cold rinses. After one cycle, the concentration of contamination would be reduced by replacement alone to 96 per cent of the original value and after ten cycles only to 62 per cent, which is not very effective rinsing. Some other explanation for the effectiveness of hot-and-cold rinsing must be sought.

(2) Neutralization of strongly acid or basic materials in the pores after plating is effective in reducing spotting-out. Naturally strong acids are unsuitable for this purpose. In the case of copper deposits, citric acid was the best of those used for neutralizing bases and sodium cyanide was preferable to the other alkalies tried for neutralizing acids. Tartaric and boric acids were definitely inferior to citric acid, and borax and ammonia gave very poor results when substituted for sodium cyanide. About 1 per cent solutions were employed in all cases as it was felt that these dips should not be too concentrated.

(3) If it were possible to remove all traces of liquid or solution from the pores, there should be no spotting-out problem. There are on the market various dewatering liquids which are organic materials that

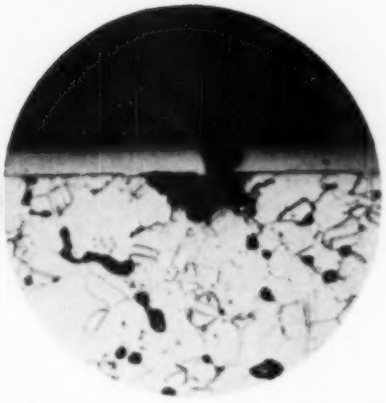


Fig. 6. Nickel plate on buffed specimen after 11 weeks' exposure. Note corrosion of brass at perforation in nickel. 500X

preferentially wet a metal displacing the water and that can subsequently be removed readily themselves by air drying, forced drying, or in a vapor degreaser. Using such a material as Enthone Water Displacing Liquid No. 1, for example, and drying in a degreaser gives the most pronounced improvement of any treatment except mechanical working of the surface. Some care is necessary in degreasing at this point to prevent staining, which is somewhat more critical than with a deposit directly upon rolled metal.

To summarize this part of the work, it may be said that in preventing spotting-out all the post-plating treatments mentioned have some value. The very best results are obtained when all are used. The most effective are dewatering, hot-and-cold rinsing, and neutralization in descending order of preference. Actual service tests will be necessary in individual cases to decide how far it is necessary to go with this special treatment. Since the correlation between actual service and the humidity test results on which these observations are based is not known, the fact that the sensitive type deposits usually are coated with a clear lacquer which furnishes an outstanding resistance to spotting-out lends further weight to the belief that not all of these precautions will be required in every case.

As would be expected from the relative porosities shown by the drag-out test, the mechanically worked surfaces, especially the buffed surfaces, are most resistant to staining. Where the nature of the work permits, an operation of this type should certainly be used.

Outdoor Service

Outdoor exposure tests have been made on many of the metal powder compacts plated during this work. These tests were made at Palmerton, Pa., in an industrialized atmosphere over exposure periods of 11 weeks. The test pieces involved were all plated with either nickel-chromium or copper-nickel-chromium with the nickel applied in two thicknesses, 0.3 and 0.5 mil. Variations in compacting and in surface preparation were included.

Tests of this sort are highly preliminary in nature, but a few indications from them seem worthy of note:

(1) In general, no essential difference in performance was observed between nickel-chromium and copper-nickel-chromium deposits of the same nickel thickness. This is reasonable since the mode of failure was by the production of copper sulfide stains on the surface.

(2) There was one exception to Conclusion 1. Some but not all of the specimens which were plated with nickel direct on a compact surface which had not been altered mechanically before plating showed no failure during the 11 weeks of exposure. No explanation for this difference in performance between apparently duplicated specimens is available.

(3) Under best conditions, plated metal-powder compacts equaled or in a few cases bettered the performance of similarly plated buffed rolled brass. The former were much more erratic in behavior, however. The relation of this variability to specimen porosity and preparation techniques cannot be deciphered from the data. However, no compacting variable studied, including re-pressing, had a determinable effect on outdoor-exposure performance.

(4) 0.5-mil nickel coatings were superior to 0.3-mil coatings only with respect to the number of spots at which copper staining developed. The approximate total areas stained by salts exuding from these spots were comparable in the two cases.

The superior performance of some of the direct nickel plated, unbuffed specimens is surprising since it is to be expected that coatings of the order of 0.3 mil would be perforated by corrosion in the severe atmosphere of the test. Microexamination of the exposed samples has furnished a tentative basis for an explanation. When the coating on the unbuffed pieces was penetrated, the brass was not attacked because the nickel dissolved anodically to protect it (Fig. 5). When the part had been buffed, the brass dissolved anodically to protect the nickel (Fig. 6). This apparent reversal in the potential positions of nickel and brass due to the working of the surface in buffing needs substantiation before it can be accepted, but the microscopic evidence is persuasive.

Any connection between points of failure of the plate and pores in the compact would be difficult to establish or refute. One is inclined, however, to attribute the variability of the outdoor exposure performance to this factor.

General Microscopic Observations

In addition to the observations just referred to, two other phenomena were noted during a careful study of the specimens. One of these, an astonishing ability to deposit sound metal in deep pores, has been shown

in some degree in Fig. 3. The other was an equally astonishing leveling of the unbuffed, bright nickel plate over badly nodulated copper. Typical illustrations of both phenomena are shown in Figs. 7 to 9, inclusive.

Both phenomena are worthy of careful study since improvements in plate appearance and quality seem implicit in them. The work of Gardam* and others on leveling power involves the same considerations.

While the present investigation was somewhat limited in scope, it seems probable that had not most of the pores been filled with metal, the spotting-out problem might have proved insurmountable. One may hope that an elucidation of the mechanism of the deposition of metal in pores will result in finding means for filling all of the openings in metal powder compacts.

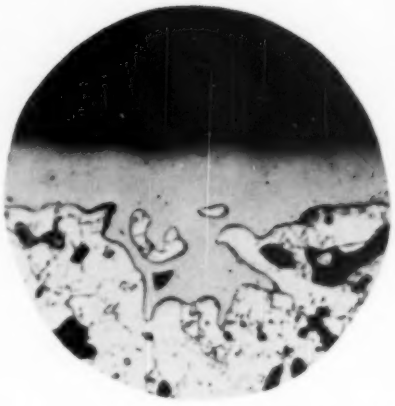


Fig. 7. Nickel deposited in deep pores. 500X

Tentative Plating Cycles

It is not to be expected from the exploratory nature of the present work that rigorously defined plating cycles can be drawn up for the plating of metal powder compacts. With the hope, however, that they will be of assistance to the plater in getting a start in the field, the highly tentative cycles below are offered for consideration. In drawing up these cycles, every precaution known to the authors has been included, which may make the procedures seem unduly complex. It is expected that the plater will find out for himself just how far he can safely relax the indicated precautions in each individual case.

In the preparation of these cycles, it was essential to recognize a range in the inspection and service requirements as well as to differentiate between the procedures needed for producing decorative plates of the spotting-out sensitive type and nickel-chromium coatings for severe service. The following classes were recognized:

(1) Plating with copper-nickel-chromium
(2) Plating with nickel-chromium
(3) Plating with copper and other sensitive metals

(1) *Plating with Copper-Nickel-Chromium*

This procedure includes a copper plating and buffing step aimed to produce a final surface better than that obtainable with nickel direct. The need for these extra steps will depend upon the surface perfection of the compacts and the perfection requirement of the plate.

(a) Mechanical Preparation
  (1) Buff with medium coarse greaseless compound
  (2) Buff with fine greaseless compound

(b) Cleaning
  (1) Emulsion or alkali soak
  (2) Electroclean anodically in a cleaner suitable for wrought brass
  (3) Hot rinse followed by cold rinse; repeat
  (4) Dip in 1 oz/gal sodium cyanide solution
  (5) Hot rinse followed by cold rinse; repeat
  (6) Dip in 3–5 per cent by volume sulfuric acid solution
  (7) Hot rinse followed by cold rinse; repeat

(c) Copper Plating
  (1) Copper plate to an average thickness of 0.001 inch in an acid copper solution
  (2) Hot rinse followed by cold rinse
  (3) Dip in 1 oz/gal sodium cyanide solution
  (4) Hot rinse followed by cold rinse; repeat
  (5) Hot rinse and dry

(d) Copper Buffing
  (1) Cut with fine greaseless compound or rubber-bonded wheels
  (2) Color with dry lime compound

(e) Copper Cleaning
  Same as preplating cycles, items b-1 through b-7

(f) Nickel Plating
  (1) Plate to minimum thickness of 0.0003 inch in bright nickel solution
  (2) Hot rinse followed by cold rinse; repeat
  (3) Chromium plate—standard practice
  (4) Drag-out rinse
  (5) Hot rinse followed by cold rinse; repeat
  (6) Rinse in hot water and dry

(2) *Plating with Nickel-Chromium*

This procedure may be used where the quality of the compact or the unimportance of surface perfection permits. It is essentially the same as Procedure 1 but omits steps c-1 through c-5, d-1, d-2, and e, going directly from step b-7 to step f-1. Step a-2 should be followed by a coloring operation with a dry lime compound.

(3) *Plating with Copper or Brass*

(a) Mechanical Preparation
  (1) Buff with medium coarse greaseless compound
  (2) Buff with fine greaseless compound

*J. Electrodepositor's Tech. Soc. **22**, 155–168 (1946–1947).

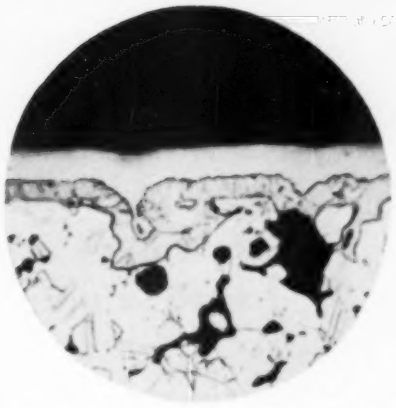


Fig. 8. Copper and nickel deposited in deep pores. 500X

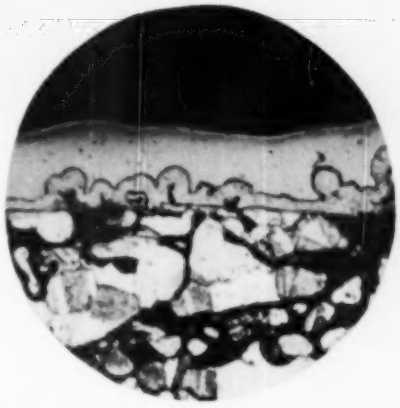


Fig. 9. Unbuffed bright nickel deposited over nodular copper. Note leveling. 500X

(3) Color with dry lime compound
Note: Care in this stage will be reflected in improved final appearance. Step 3 may be omitted if final texture is to be satin.

(b) CLEANING
(1) Emulsion or alkali soak
(2) Electroclean anodically in a cleaner suitable for wrought brass
(3) Hot rinse followed by cold rinse; repeat
(4) Dip in 3–5 per cent by volume sulfuric acid solution
(5) Hot rinse followed by cold rinse; repeat
(6) Dip in 1 oz gal sodium cyanide solution
(7) Hot rinse followed by cold rinse; repeat

(c) PLATING
(1) Plate in cyanide copper or brass (according to desired final appearance) to a minimum thickness of 0.0002 inch
(2) Hot rinse followed by cold rinse
(3) Dip in 1 per cent hydrochloric or citric acid (latter preferred)
(4) Electrolyze cathodically for 1 minute at maximum voltage in 0.15 to 0.3 oz gal solution of chromic acid
Note: This step is optional and may be omitted if satisfactory results can be obtained without it.
(5) Hot rinse followed by cold rinse; repeat twice
(6) Immerse in Enthone Dewatering Liquid or equivalent for 2 minutes with occasional shaking
(7) Degrease carefully in vapor degreaser to avoid straining

(d) PLATE BUFFING AND LACQUERING
(1) Buff with fine greaseless compound
(2) Color with dry lime compound if high luster is desired
(3) Solvent wash or degrease
(4) Coat with a good lacquer

SUMMARY

In summarizing the information presented in this paper, emphasis must again be placed on the exploratory nature of the studies. It is felt, however, that the principal difficulties to be expected in the plating of pressed metal powder parts have been determined and the general procedures to overcome these difficulties disclosed.

In general, five points seem of principal importance:

(1) *Drag-over.* Regardless of the type of finish and the service requirements, drag-over is an important matter in the plating of pressed metal powder parts. The plater must recognize this and take proper precautions to avoid serious contamination of his solutions.

(2) *Finish Perfection.* Any attempt to produce a plated surface of flaw-free appearance will require special procedures and may require improvements in the fabrication of the compact. Best results are likely to be obtained with a heavy copper primary deposit applied over a buffed surface and in turn buffed after deposition.

(3) *Mechanical Preparation.* The mechanical preparation of a metal compact surface for plating seems to have some limitations. Ball burnishing has not been successful nor has buffing with grease compounds. Greaseless compounds have given the best results to date. Much further work is required on this phase of the subject.

(4) *Spotting-out.* Spotting-out is a local problem to be expected only with those coatings such as copper and brass which are sensitive to this defect. Special precautions are necessary in the rinsing and post-plating treatments to minimize this effect.

(5) *Outdoor Service.* While future studies and commercial experience may produce evidence to the contrary, the present information does not indicate that the outdoor service performance, particularly of nickel-chromium coatings on pressed metal powder parts, is largely influenced by the preparation procedures used.

WACLAW ANDREW WESLEY

IT CAN BE STATED without fear of contradiction that Dr. Wesley was born in Yonkers, New York, on August 24, 1902, and that he reacts violently to the simple question, "What are Yonkers"? In the Yonkers High School his record shows two interesting sidelights: (1) he worked his way up in the high school orchestra from the second violin section through the first violins to the first desk and became president of the orchestra in his senior year, and (2) he accidentally developed a new proof for one of the ancient Greek theorems in geometry class, blissfully unaware that he had not used the conventional method. He also won two scholarships which served him well through his four years at Cornell University.

Dr. Wesley left Cornell with the degree of Bachelor of Chemistry and the scholastic honors of election to Sigma Xi and Phi Kappa Phi. He then earned the degrees of Master of Science and Doctor of Philosophy at New York University. During this time a blonde music student began to interfere with his strict attention to chemistry and the girl became his wife after she had graduated from Columbia University. Her name was Mary Hartman, of Windber, Pennsylvania.

According to her, industrial research looked like a happy medium between the alternatives of university life or working for a living so Dr. Wesley joined the staff of the Research Laboratory of The International Nickel Company at Bayonne, New Jersey, in 1926. Devoting his time and interest to the two main fields of corrosion and electroplating, he was made head of the groups studying these subjects in 1933 and in 1929 became Assistant Director of the laboratory. An impressive number of publications and patents in both fields bear his name.

In addition to the American Electroplaters' Society, Dr. Wesley has been a member for many years of the Electrochemical Society, American Society for Testing Materials, American Chemical Society and Faraday Society (England). In 1939 he was awarded the A. E. S. Gold Medal for his paper on "The Physical Properties and Uses of Heavy Nickel Deposits". He won the A. E. S. Award with E. J. Roehl in 1943 for their paper on "Reclaiming Nickel from Idle Plating Baths". His studies of high-speed nickel plating have also attracted much attention. At this time he is serving his second term on the A. E. S. Research Committee, having been a member previously, from 1937 to 1940. He is a Vice-Chairman of its Research Directing Sub-Committee and Chairman of Project Committee No. 6.

In the field of corrosion Dr. Wesley is known for his studies of the behavior of nickel and nickel-containing alloys and of methods of rating corroding electrodeposits.

On the lighter side, his life is full of music. His only child, a daughter aged thirteen, is a composer and pianist. The Wesleys live in Plainfield, New Jersey, so there is ample opportunity to attend concerts and recitals in the New York area and this is an engrossing hobby. For more complete relaxation Dr. Wesley resorts to gardening and to taking automobile trips.

A BRIEF HISTORY OF TIN PLATE

SAMUEL S. JOHNSTON

Weirton Steel Company, Weirton, West Virginia

The manufacture of tin plate is an ancient art.

Early records show that the Bohemians were making tin plate in 1240 near the border of Saxony and Bohemia. Progress continued there through 1665 when an Englishman, Andrew Yarranton, learned enough of the secrets to make a beginning in England. In 1670 he established a small plant at Pontypool in Monmouthshire, Wales, where "tinned over" iron plates were made.

The real development of the tin plate industry was destined to take place in Wales which had tin mines in nearby Cornwall, abundant water supply, and an industrious population. There is a great number of "Old Timers" still working in the Weirton mills who learned the art of tin plate manufacture in their native Wales.

In 1728 significant progress was made when sheets were rolled, replacing the old method of hammering the base metal from iron bars. In 1770 steam was substituted for water power and coke for charcoal. Other important improvements that followed included the invention of the pickling machine, the annealing pot, and the mechanical coating of the plate. Sieman's steel was substituted for charcoal iron in 1875 and bessemer steel for the puddled iron bar in 1880.

The tin plate industry grew rapidly in Wales and by 1889 the British interests held a world monopoly.

The site of the first commercial production of tin and terne plate in the United States prior to the McKinley tariff was a plant at Wellsville, Ohio, just a few miles north of Weirton on the Ohio river. The plant was erected in 1873–1874, but tinning was discontinued in 1874 when Welsh manufacturers reduced the price of tin plate imports. Other early tin mills were at Leechburg, Pa., and Demmler, Pa.

The McKinley Protective Tariff Act of 1890, however, helped to complete the establishment of the American tin plate industry. Rapid progress followed and the Pittsburgh, Western Pennsylvania and Eastern Ohio area took a leading part in adding tinning equipment to existing mills. By 1895 there were about 32 plants doing tinning only and some 37 rolling mills having a total of 159 hot-pack mills.

The nation's demand for tin plate continued due to strides made in can manufacturing and food packing. Tin plate production in the United States passed the 1,000,000 ton mark in 1912 and the 2,000,000 mark in 1923.

The advent of the cold reduction process of rolling steel in 1929 started revolutionary changes in tin plate manufacture. The last tin plate hot-pack mill in the United States (at Washington, Pa.) was discontinued in 1943.

The next big and important development in the tin industry was the success of experiments with electrolytic tinning.

In September, 1939, World War II broke out and the industry labored to achieve maximum production. In 1941 over 4,000,000 tons of tin plate were produced. But when Japan struck at Pearl Harbor and cut off the Malay States and Dutch East Indies, the United Nations were deprived of their principal source of tin, a very serious matter. However, reserve stocks in this country and limited supplies from Bolivia tided us over the war years, aided materially by the fact that electrolytic lines were built which cut tin consumption to the very minimum.

Originally, electrolytic tin plate with its very thin tin coatings was primarily intended for use in cans for "general line" products such as motor oil, dry products, plain and similar commodities. Can manufacturers soon found, however, that when electrolytic plate was enameled it provided satisfactory performance with a number of less acid foods. Consequently, enameled electrolytic tin plate has come into widespread use for food products. More than 2,500 products from foods to pharmaceuticals, and from motor oils to milk, are now normally packed in cans by over 135 different industries.

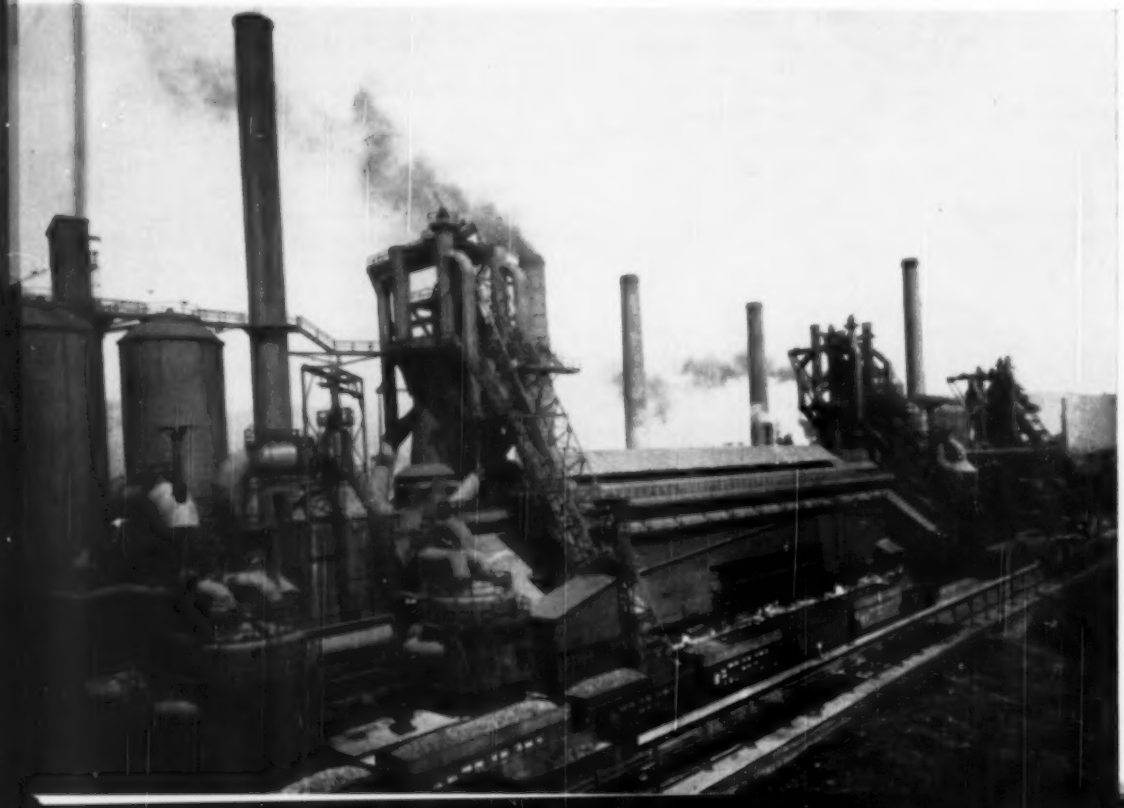
The story on the next pages shows how electrolytic tin plate is made at Weirton. ➡

Electrolytic Tin Plate

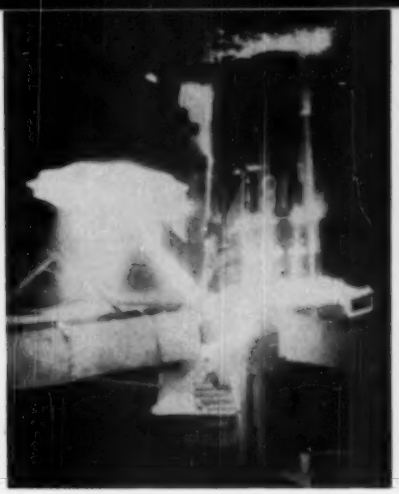
This story comes from Weirton Steel Company, Weirton, West Virginia, one of the pioneering independents not only in the field of electrolytic tinning but also in cold-reduction of steel which supplied the basic equipment for handling of steel strip at high speeds. It installed the first electrolytic equipment in 1938. Of its three 550-feet long strip plating lines in operation during the war, one has now been converted to electrolytic zinc plating. A fourth electrolytic line for tin plate production is now under construction. Each tin line plates, each 24 hours, an average of 3,250,000 sq.ft. of steel, or 6,500,000 sq.ft. of surface.

The information and illustrations shown here were furnished by Mr. S. S. Johnston, Technical Director of the Company's Electrolytic Department and until this month President of the American Electroplaters' Society, and Mr. J. A. Jones, Editor of Weirton's Employee's Bulletin.

The steel-making process starts in these three huge blast furnaces, each about the height of a fifteen-story skyscraper. Four times each 24 hours the molten pig iron is withdrawn and sent by rail to the Open Hearth Mixer, a 1300-ton "thermos bottle" which holds it for the next step, in the Bessemer converters



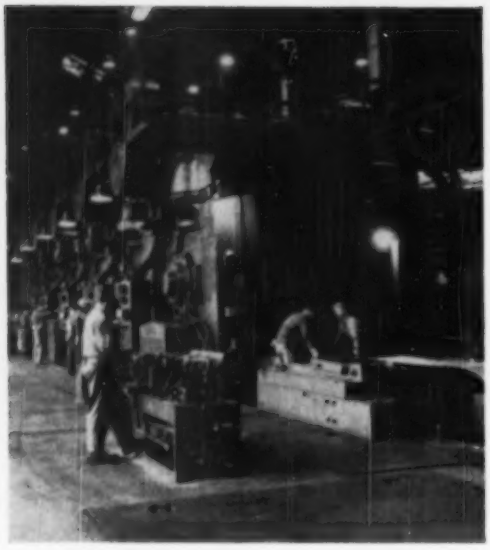
When the Bessemer is in full blast, billowing waves of flame light up the sky. Air is blown through the molten pig iron to burn away most of the impurities. The iron then goes to the Open Hearth where it is mixed with scrap and treated for 12–13 hours at 3000° F



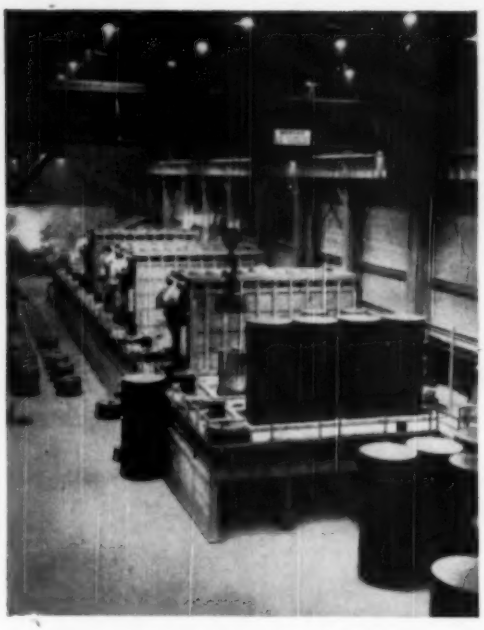
Tons of liquid new steel are "tapped" into waiting ladles from one of Weirton's Open Hearth furnaces to be cast into ingots. Slag flows out last and spills over the filled ladles into adjacent "thimbles". Impurities are trapped in the slag

Having been brought to uniform heat in soaking pit furnaces, the red-hot ingot approaches the giant rolls of the Blooming Mill to be rolled into blooms, billets or slabs. The desired protective coating of scale can be seen on the ingot

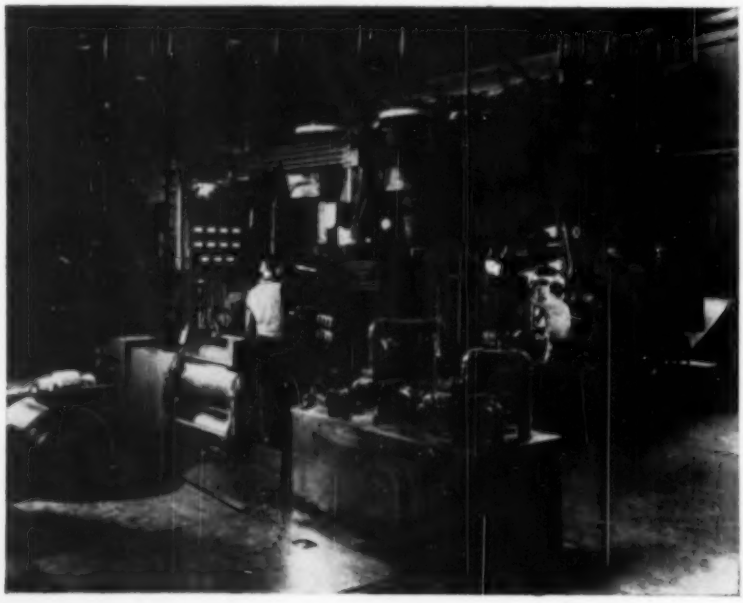
The high-speed Hot Mill is a highly important unit in the series of finishing operations. This big mill reduces reheated slabs from the Blooming Mill to coils of steel 0.078 inch thick and 750 feet long, at the speed of 1620 feet per minute. Placed in operation on January 29, 1947, the 54-inch Mill has doubled production of its predecessor, an old 48-inch Mill which started operation in August, 1927 as the world's first mill of this type. As it leaves the Hot Mill the strip is cooled under water sprays on a 285-feet long table, coiled, and cooled further



Mile-a-minute mill where the steel is finally reduced to tin plate thicknesses by cold reduction is preceded by a pickling operation by which all scale and other foreign matter is removed from the surface. In this view, skilled workmen send strip whizzing through five stands to be reeled in 15-ton coils containing 5 miles of strip. The coils are loaded onto railroad cars for the finishing processes in the Sheet Mill, Steubenville Plant and the Tin Mill.

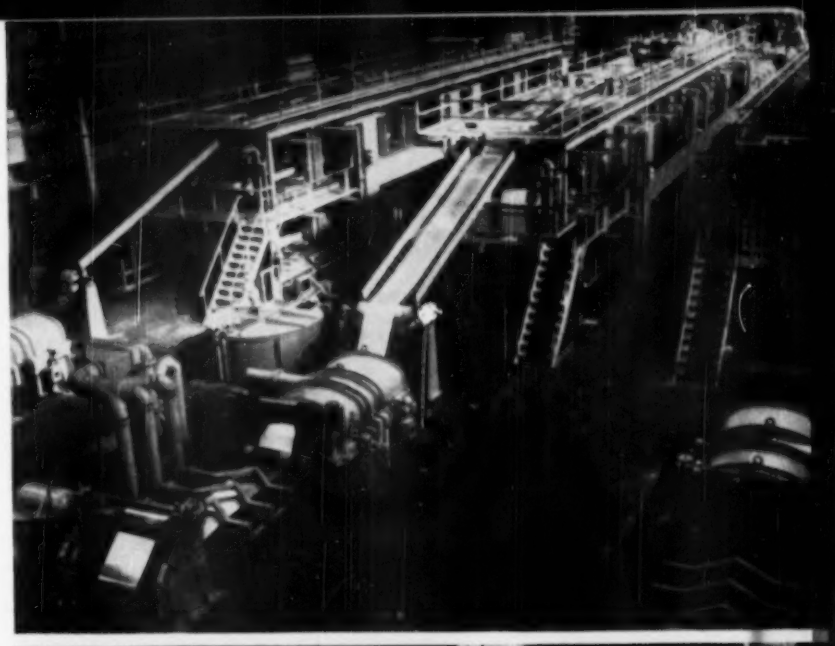


These four huge furnaces in the new annealing building, 85 feet high with floor area of 30,000 square feet, serve to anneal the strip coils in controlled atmosphere. Weirton operates 23 old type and four huge new type furnaces in its Tin Mill. The old furnaces hold an average of 80 tons of steel strip, the new average 260 tons



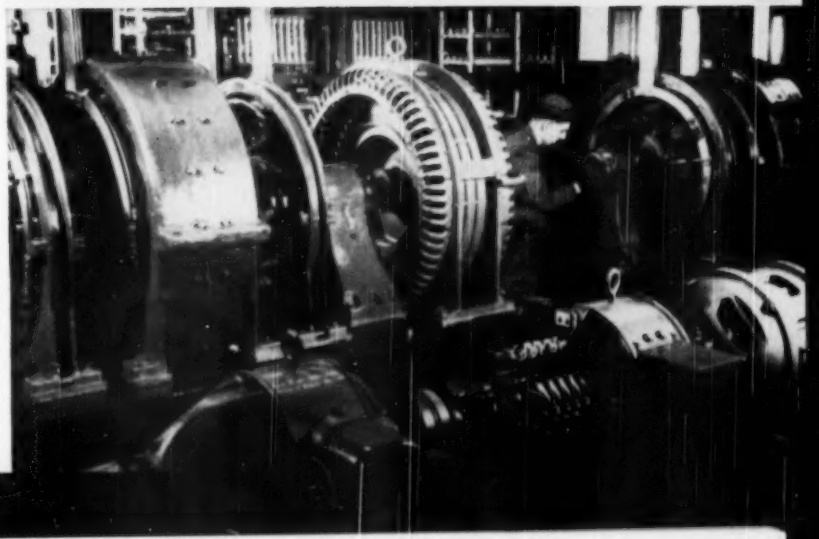
This giant No. 2 Temper Mill gives strip steel a high-speed, light cold-reduction pass to add a slightly cold worked "skin" and prepare it for coating. Hence it is sometimes called a "skin mill"

The two electrolytic tin plate lines (left and center) have a total length of 550 feet and handle strip at 750–1500 feet per minute. In the background are the uncoilers, pinch rolls, shear and seam welder, looping pit to furnish strip while a new coil is welded to the ends of an old one, tension rolls, electrocleaner, pickling tank and water scrubber. In the 90-foot long, three-decker plating units, the underside of the strip is first coated on the first deck; then the strip is reversed and coated on the other side on the second deck, reversed again and rinsed on the third deck. In front are the drying, the high-frequency induction-melting, and the cooling units, following which the strip goes to recoilers

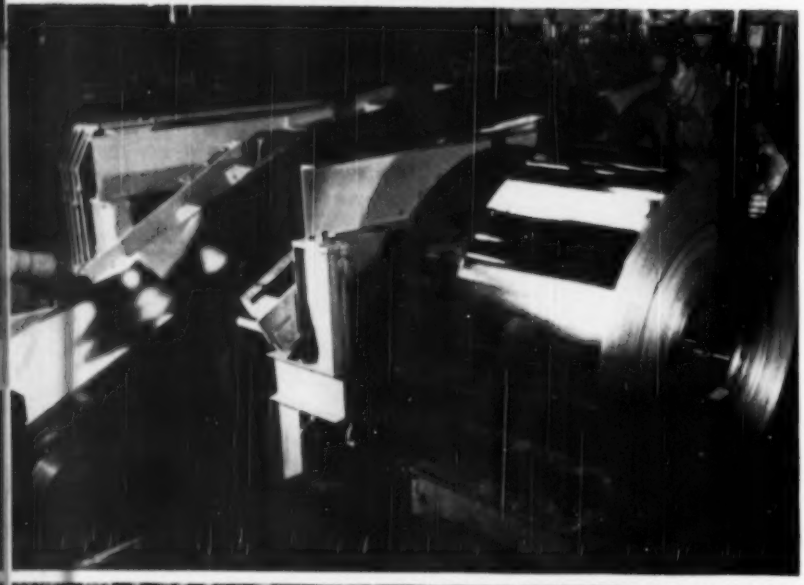


Here can be seen the strip skinning the surface of one of the 24 plating cells in each machine. The bath, a "halogen" solution containing stannous chloride and fluoride which is operated at 150° F and 250–350 asf, gives tin coatings with 0.25–1.0 pounds of tin per base box. Tin anodes are in the bottom of the tank only. Note the contact roll to the left with its carbon-brush arrangement; this is better illustrated in the cover picture which also shows the work of the rubber-covered back-up roll underneath the steel contact roll with its copper sleeves on the ends

The 120,000 amperes of current required by each line are furnished by generators like these, 5000 ampere-12 volt units, four of which are driven by one synchronous motor



Tremendous quantities of copper bus bar are required to conduct the current to and from the plating cells. Their ends are silver plated to reduce voltage drop across junctions



The finished tin plate strip is recoiled, and the 30,000-pound coils are ready for cutting

The huge coils are cut on these flying-shear lines which trim and cut them to ordered size at 600 feet per minute by means of drum-type rotary shears. The girls who inspect the strip control switches which activate a gate that directs off-grade sheets to a reject box

plating generators

their use and some new construction features

E. G. SCHROEDER*

The Electric Products Company, Detroit, Michigan

THE OPERATOR of a plating plant is so continually confronted with either production costs or technical problems related to the plating process itself that he seldom has time to think of other items which can have a surprising influence on the profitable operation of his plant.

One such item in his operating cost is his d-c power source. It is one of the largest single items of initial shop investment, and power and maintenance costs are a significant part of operating expense.

The average plating operator is also faced with sharp peaks and valleys of production, more aggravated than in most other businesses. At the same time, his business is highly competitive. He must be strong in every phase of his control over quality, delivery, service, etc. And all of these factors are affected by the d-c power source.

The d-c power source should be as modern and an efficient as money can buy because it must be depended upon (1) to carry the peaks of the heavy-production necessary to capitalize on good market conditions, and (2) to be as efficient and as economical as possible, both during lull business periods when conditions are highly competitive and when it is necessary to operate at peak efficiency. If the plating generator is not capable of doing its job at all times at high efficiency and with a minimum of maintenance, high operating costs and production delays result.

A Plant Survey

About two years ago, The Electric Products Company, searching for a guide in the design and manufacture of power equipment for the plating industry, made surveys in plants that were considered to be some of the most modern in the industry. The following case histories show how reductions in power and maintenance costs in excess of 50 per cent were actually accomplished, with many other supplemental advantages.

1. One of the most important factors is the proper *utilization of the existing equipment*, taking advantage of the maximum available output. One plant is now saving in excess of $3,600 per year by better utilization of existing equipment and elimination of tank rheostats. Another company saved the purchase price of a 5000-ampere, 9-volt motor-generator set by rearrangement only, saving over $8,000.

2. A large saving can be realized when a program of *replacing obsolete and inefficient power equipment* is in force. In *all* of the cases surveyed, power costs could be reduced 20–50 per cent by this means. Maintenance costs could, at the same time, be so materially lowered that in many cases the price of new equipment would be paid out of savings made in from 12 to 30 months. Specifically, a company with a total installed capacity of about 30,000 amperes could realize enough positive savings to replace the obsolete and inefficient equipment and pay for it completely in two and one-half years with a capital outlay of about $10,000. Thereafter, they will realize an annual saving of $3,255 in power costs and $1,800 in maintenance costs, making a total annual savings of $4,255 with the $10,000 investment.

3. In another plant an excess of $5,000 was spent per year for stripping and replating because of shutdowns of old and unreliable power sources that occurred during the plating cycle and spoiled the work.

4. Another plant saved a $12,000 plant rewiring job through correction of the plant power factor by using leading power-factor synchronous motors on modern plating generators. In addition to saving the rewiring cost, it has actually realized a saving of $1,259 per year by reducing the demand charge and a $2,089 reduction in power cost.

*Now with Arthur B. Somerborn Company, Detroit, Michigan

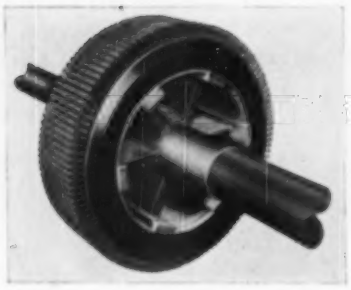


Fig. 1. Open construction permits ready passage of the cooling ventilating air *Fig. 2. Equalizers on commutator bars promote better fan-cooling action* *Fig. 3. Welded steel frame results in greater strength with less weight and more flux-carrying capacity*

That power-factor correction alone can affect the plant wiring is made clear in the following example. The limiting factor in wiring is the heating effect which, according to Ohm's law, is the current squared times the resistance (I^2R). With a 0.60 power factor, only 60 per cent of the current can be converted into useful work but 100 per cent must be carried by the wires. The ratio of heat produced at 0.60 and 1.00 power factors with the same amount of useful current is, therefore: $0.6^2/1^2$ or 0.36. With unity power factor the wires are subjected to only about $\frac{1}{3}$ the heat that they were before and will have capacity to carry the load at good power factor for a great many years to come.

The survey led to the definite conclusion that there is a substantial opportunity for lower costs in all plating plants. The following steps are required to realize this opportunity:

1. Detailed analysis of actual power requirements for each process.

2. Careful application of the power equipment to make more efficient use of that which is available.

3. Scheduling of production so that available amperes are working as much of the time as possible.

4. Improvement in power factor by use of leading power-factor synchronous motors on modern plating generators.

5. Use of reliable power supply to assure continuous production and eliminate spoiled work with resultant stripping and replating costs.

6. Setting up a program of replacement of obsolete and inefficient power sources with modern, reliable, efficient and low maintenance-cost motor-generator equipment to produce savings in power and maintenance costs.

The improvements in basic generator design and the use of new and better materials make possible machines far superior to anything thought possible as little as ten years ago. Since these improvements have come one at a time and unheralded, their accumulated effect can make a very impressive contribution to increased profits in the plating plant.

Before these improvements will be discussed a few words need be said about basic considerations.

Efficiency and Maintenance Cost

Once the d-c power plant is operating, there are only three things to consider:

1. How much power will be consumed for a given number of pieces produced? In other words, how big will be the electric power bills?

2. How much is it going to cost, averaged over a reasonable life-time expectancy, to maintain the equipment from the viewpoints of both time and material?

3. How much out-of-time service will be required to maintain the equipment?

The developments in basic generator design are all in the direction of building a more efficient, more reliable and lower maintenance-cost machine. The end result is the production of more pieces at a lower overall cost.

Since the operating efficiency of the d-c power supply so vitally affects the overall profit, it will be well worth while to consider an example which will illustrate the savings that can be effected.

Many people have become accustomed to speaking so freely of efficiency in terms of a few insignificant percentage points that the word has lost its meaning. However, the word quickly regains its full meaning when *quantity* and the *time element* are taken into consideration.

Let us consider a very elementary example. Company "A" has a generator rated 5000 amperes at 12 volts. This machine is 20 years old and has an operating efficiency of 60 per cent. It produces 5000 amperes x 12 volts = 60 kilowatts. To do this it requires 60 divided by 60 per cent = 100 kilowatts. Company "B" has a modern machine also rated 5000 amperes 12 volts. This machine also produces 5000 amperes x 12 volts = 60 kilowatts. But it has an efficiency of 80 per cent and requires only 60/0.80 = 75 kilowatts of a-c power to supply the same plating power.

The difference in operating efficiency is a mere 20 per cent or 25 kilowatts. But on an annual basis,

assuming a conservative 3000-hour working year and an energy charge of 1½ cents per kilowatt hour, the saving is 3000 x 25 x 0.015 = $1126.

A different example, this time an actual installation. This company had three large semi-automatic copper plating machines with electrified cleaners. Each tank was supplied by a 6000-ampere, 6-volt machine, from which about 1000 amperes were used for the cleaners and the balance of 5000 for copper plating. The voltage was dropped to about 3 volts for the plating operation through tank rheostats.

5000 amperes x 3 volts = 15 kw loss in rheostat

5000 amperes x 3 volts = 15 kw used in solution

In terms of overall efficiency 15 kilowatts, or 15/36 = 40 per cent of the total output, was wasted. Thus a 75 per cent efficient generator provided an overall efficiency of only 75 x 0.60 or 45 per cent. The same operations were carried out by using one machine on each copper plating tank only, operating around 3 volts without appreciable loss in efficiency, and supplying the cleaners from a separate current source. Since the power used to heat the rheostat was generated at a generator efficiency of about 75 per cent and therefore the actual loss was 15/0.75, or 20 kilowatts, this resulted in a yearly saving (on 2-shift operation) of:

3 machines x 20 kw x 4000 hours x $.015 = $3600

Efficiency Factors

The losses which are common to all machines consist of the copper loss, iron loss, and the friction, windage and stray-load losses. The stray-load loss is a small percentage of the total, and windage is also of small importance and more or less fixed for a given machine operating at a particular speed.

The copper loss, which is the heating effect due to resistance, is the square of the current times the total resistance of the conducting copper in the machine. The current in amperes is fixed by the rating of the machine, so that to reduce copper loss and increase efficiency, it is necessary to reduce the resistance of the machine. This may be done in two ways, (1) by the generous use of copper in all series parts of the machine, (2) by good ventilation and the most effective use of ventilating air. This point is particularly important because the resistance of copper is a direct function of its temperature. At lower temperatures, copper loss is materially reduced.

The color photo and Fig. 1 show the open construction of modern motor generators. There are no barriers to passage of cool ventilating air. In addition, the equalizers on the commutator (Fig. 2) act as fan blades to pull air through the inside of the armature.

The iron loss, which is the energy required to magnetize the iron in the machine, is next in importance. Cast iron has many times the resistance of mild steel to the flow of magnetic lines of force. It is, therefore, imperative that steel frames be used throughout the motor-generator (Fig. 3) to reduce iron loss to a minimum and raise the operating efficiency.

The frictional loss in a generator is principally caused by the brushes riding on the commutator. It is a function of the speed at which the surface of the commutator is passing under the brushes, the pressure applied to the brushes, and the coefficient of friction of the contact surfaces.

Brush Life

The most important item in maintenance is the replacement of brushes. Modern motor-generators are designed so that they will operate satisfactorily with approximately one-half the brush pressure previously considered necessary, and therefore brush life is increased many times. It is not uncommon for brushes in modern motor-generators to last in excess of 15,000 hours.

This reduction in pressure is made possible by the correct electrical and mechanical design of the generator, particularly around the commutator and brushholder, as discussed previously. Any sparking at the brushes or vibration of the brushes in their holders inevitably accelerates their wear, shortens their life, and very materially increases maintenance costs.

Design Details

Modern motor-generators are carefully designed throughout, both electrically and mechanically, to assure sparkless commutation under all operating conditions. This factor, in addition to the use of sturdy

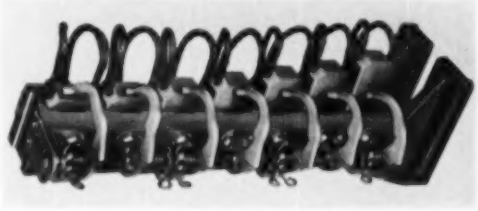


Fig. 4. One-piece brushholder assures elimination of vibration

and accurately machined brush-holders (Fig. 4) which assure perfect and permanent alignments of the brushes as well as freedom from vibration, makes possible a reduction in the amount of pressure on the brushes that is necessary for satisfactory operation. It reduces frictional loss to the extent of raising the overall efficiency of the machines by 2 to 3 per cent.

The following is a detailed discussion of several of the features that a modern generator should have.

Undercut Mica. One of the difficulties with the older low-voltage generators was the inability of the brushes to last an appreciable time. The mica that is used as insulation between the commutator bars is harder than copper and therefore does not wear as rapidly as the commutator bars. As soon as the mica was at a higher

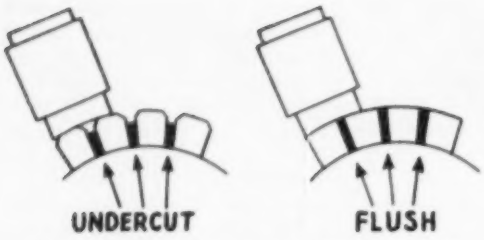


Fig. 5. Undercutting the mica insulation raises brush life

Fig. 6. Collecting rings of rolled copper (in front) reduce bulk and increase efficiency

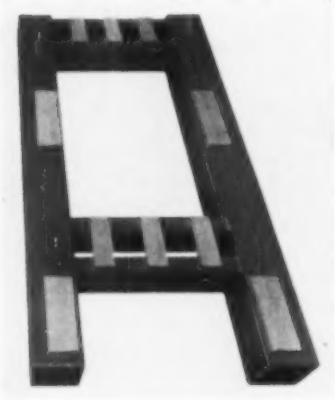


Fig. 7. Welded steel base replaces heavier, less dependable cast iron

level than the copper it would start wearing the brush, because it is also harder than the brush material. Even more serious was that the intimate contact between the brush and copper was destroyed. This caused sparking, which in turn caused further wear of resulting unstable operation of the generator and excessive heating.

Undercutting the mica (Fig. 5) is a refinement in construction practice made possible by accurate control over mechanical variations. It results in longer life of both brushes and commutator and in higher efficiency.

Rolled, Hard-Drawn Copper Collector Rings. For years the industry used cast-brass collector rings, which have a current carrying capacity of 200 amperes per square inch of perfect casting. Since blow holes do develop in castings, it was the practice to increase the cross section of the brass in order to make certain of at least one square inch of brass per each 200 amperes output. While this practice theoretically overcame the difficulty, it resulted in waste of material and bulky construction.

The solution to the problem was to roll hard-drawn copper for the collector rings. This accomplished a more uniformly appearing and better operating generator with considerably less bulk. Since hard-drawn copper is a solid material with no blow holes, it is unnecessary to provide extra material. And since copper will carry 1000 amperes per square inch, the bulk was greatly reduced.

As there is no waste of material, the collector rings can be rolled to the size of the frame diameter. This allows an unrestricted path for the flow of air into the generator frame and, more important, makes the internal parts of the generator more accessible for inspection or repair. (See Fig. 6.)

Commutator-Bar Equalizers. To aid commutation, every commutator bar should be equalized. These equalizers, preferably made of strap copper, should be sturdy and self-supporting. In addition to better commutation, a fan cooling action is obtained by the mechanical rotation of the equalizers, as was shown in Fig. 2.

Replacement of Cast Iron with Steel. Experience derived from changing the collector rings from castings indicated that the cast-iron frame itself could be changed. Blow-holes also develop in cast-iron and require use of excess material, and in the generator frame the blow-holes distort the magnetic flux with attendant unstable characteristic. Since steel will carry $2\frac{1}{2}$ times as much flux as cast iron, rolled-steel frames were used. The result has been greater stability, a decrease in size and weight, and a more uniform and pleasing appearance (Fig. 3).

While the cast-iron bed-plate has no particular bearing on the electrical characteristics of the generator, it does have the distinct disadvantages of large bulk and weight and questionable strength. Bed-plates are now made of steel (Fig. 7). The same reasoning was responsible for constructing the pedestal and the arma-

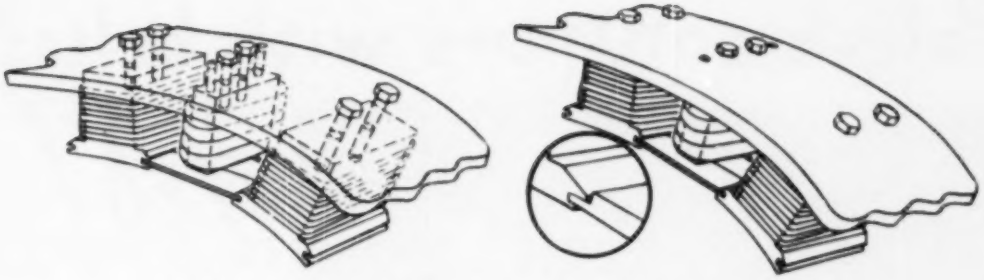


Fig. 8. Obtaining equalized pole spacing by use of adjustable depth of interpoles

ture spider of steel. The change in the latter item had even more important results: it opened up the center of the armature to allow better air cooling and increased stiffness of the shaft. (See Fig. 1.)

For the same reasons, and with the same results, steel is more desirable than iron castings in the synchronous-motor frame, stator end-plate, and rotor spiders.

Pole Spacers and Adjustable Interpoles. The most difficult electrical problem with generators was that, because of necessary clearances in drilling the frame hole, the main and interpoles were never spaced exactly evenly around the periphery of the armature. This resulted in unbalanced armature currents, which in turn gave an unstable characteristic to the generator.

The solution to this problem is simple, yet ingenious. It is based on the use of micrometer-machined pole spacers which fit into a slot in the main pole shoe. This accomplishes exact spacing of the main poles, and, with additional slots, exact spacing of the interpoles.

The exact spacing of the poles also permits the second most troublesome electrical problem to be solved. In the conventional generator having five commutator bars per pole, seven turns of wire on the interpole are too few and eight turns too many. Since the wire enters from the rear of the interpole and leaves at the front, it is impossible to make less than one complete turn.

However, since this interpole is now accurately spaced and held at the end nearest the armature, it can be raised or lowered by a system of set screws to increase or decrease its flux to the armature. As long as the number of turns on the interpole is practically correct, the interpole can be adjusted to give the desired magnetic flux. Fig. 8 illustrates these methods of construction.

Open-Type Brush Holders. The collector-bus structure for the brushes and the brush holders themselves were previously supported on a ring directly over the center of the commutator. With that construction it was difficult to inspect and change brushes.

To overcome this objection a brush-holder was developed supported from one end only (Fig. 4). This

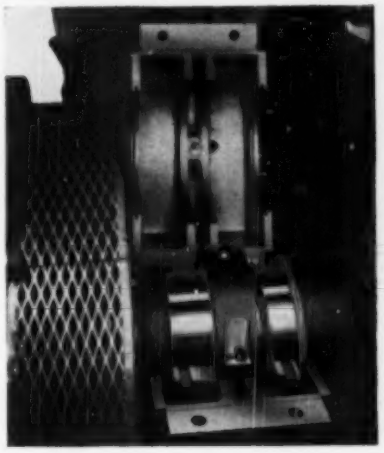


Fig. 9. One-to-one type of bearing with top cap lifted to show interior construction

type of brush-holder, of sturdy, bridgelike construction assuring vibrationless contact for the brushes, has individual replaceable fingers and springs. Because of the angle of the brush to the commutator and the direction of the spring pressure, positive contact of the brush with the commutator is assured and complete adjustment, regardless of wear and corrosion, is obtained.

An unexpected dividend was the improved cooling which resulted in a substantial reduction in operating temperature.

Bearings. The latest development is in the design of bearings. A modern motor-generator set should be built with bearings that require very little service and practically never need to be replaced. Such bearings must be designed to operate at a very low temperature so that there is no appreciable wear on the bearing lining and no breakdown of the oil film. The oil film between the shaft and the bearings must be maintained at all times, and there should be a large oil

(Continued on page 744)

Polish contours with belts?

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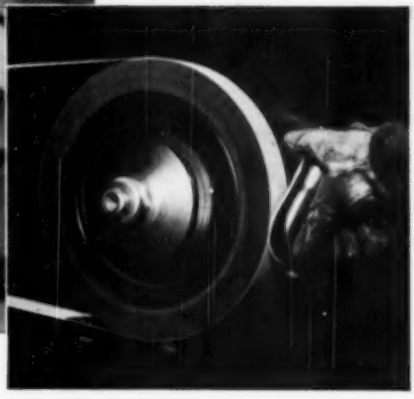

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Disposal of Plating Room Wastes

I. A CRITICAL REVIEW OF THE LITERATURE PERTAINING TO THE DISPOSAL OF WASTE CYANIDE SOLUTIONS

(Continued from the May and June, 1949 issues)

PRODUCTION OF INSOLUBLE CYANIDES

Analogous to the removal of cyanide from solution as a gaseous compound is its removal as a solid compound. The cyanides of zinc, copper, and lead are insoluble or only slightly soluble so that addition of compounds of these metals to cyanide solutions should, under certain conditions, remove the contained cyanide as insoluble cyanides. Unless such metals as zinc, copper, and lead could be recovered from such processes, their use would hardly offer an economic advantage over other methods of treatment. As discussed before, the acid treatment of solutions containing copper or silver cyanides may, under certain conditions, result in precipitation of cyanide compounds of these metals.

Some laboratory work[b] carried out with zinc sulfate, $ZnSO_4 \cdot 7H_2O$, to precipitate cyanide from a sodium cyanide solution, a zinc plating solution, a cyanide neutralizing solution, and a carburizing salt solution showed that the NaCN concentration could be reduced to 10–15 ppm. This residual is of toxic concentration and would have to be removed by some other treatment. The use of lead nitrate in the same series of experiments precipitated only 50 per cent of the original cyanide content with liberation of hydrogen cyanide. The original cyanide concentrations in these tests were about 1 per cent (10,000 ppm) NaCN.

Moir and Gray[4] reported results obtained in the laboratory of reaction between copper sulfate and cyanides in both acid and basic solution. Using copper sulfate with sodium sulfite and hydrochloric acid, they reduced cyanide to 2 ppm in a solution originally 0.01 normal (260 ppm CN). The equation for reaction in acid solution was thought to be:

$$2KCN + 2CuSO_4 + Na_2SO_3 + HOH = 2CuCN + K_2SO_4 + 2NaHSO_4$$

With copper sulfate in basic solution the reaction was thought to be:

$$3KCN + 2CuSO_4 + 2KOH = 2CuCN + 2K_2SO_4 + KOCN + HOH$$

It is not clear from the paper whether sodium sulfite was present in the basic solution or not. Both of the reactions represent oxidation-reduction changes, but because cyanide is removed in both as insoluble copper cyanide the reactions are discussed in this section.

The production of insoluble cyanides would appear to hold no particular economic attraction and will therefore receive no further comment here.

Formation of Complex Iron Cyanides. The addition of ferrous salts such as ferrous sulfate or ferrous chloride to cyanide solutions results in the formation of various ferrocyanides, soluble and nonsoluble, depending upon the particular composition of the solution. The ferrocyanides are relatively nontoxic; in fact, ferrous sulfate orally administered followed by an alkaline carbonate is used as an antidote for cyanide poisoning. If a ferric salt, such as ferric sulfate, is also present then various insoluble and nontoxic ferroferri- and ferriferrocyanides can form. A great many chemical reactions may be involved, but, since so much is unknown about them, they will not be discussed here, an exact knowledge of the reactions not being necessary for our present purposes. It may be noted that, aside from any question as to the efficacy of iron compound formation in reducing toxicity, the large volume of sludge produced and the strong color of many ferro- and ferricyanides are objectionable in many cases.

We have been informed, through private communication, that the treatment most commonly used in England for the disposal of mixed plating wastes is the

a. e. s. research project no. 10

project director:

BARNETT F. DODGE*

associate:

D. C. REAMS*

location:

YALE UNIVERSITY, NEW HAVEN, CONN.

Acknowledgment is due the Research Committee, Dr. Louis Weisberg, Consulting Chemist, New York City, Chairman; the Research Directing Sub-Committee, Mr. William M. Tucker, Eastman Kodak Company, and Dr. C. Fred Gurnham, Tufts College, Medford, Mass., Chairman and Vice-Chairman, respectively; the Project Sub-Committee, Dr. C. Fred Gurnham, Chairman; Mr. M. A. Orr, International Silver Company, Messrs. W. A. Huey and M. L. Ross (former member), E. I. du Pont de Nemours & Company; and the following individuals, Mr. L. F. Oeming, Michigan Stream Control Commission, Mr. J. G. Dobson, Foxboro Company, and Mr. J. J. Williams, Talon, Inc., for their contributions to this project.

*AUTHORS

use of ferrous sulfate followed by lime. Two tanks are used; one for carrying out treatment with ferrous sulfate and one for subsequent liming. The contents of both tanks are usually agitated with air. The method is considered satisfactory in England for cyanide wastes, chromic acid wastes, and acid wastes generally where the resultant clear effluent is run off to the sewer or the nearest stream. There are no data in the literature regarding these installations (though Mulcahy[108], writing for English platers, states that the use of ferrous sulfate plus lime is satisfactory) but it would appear that they are used by small plating shops producing a wide range of waste compositions. We have no reports concerning the use of ferrous salts in the United States for treating cyanide wastes, though ferrous sulfate is used for partial treatment of chromate plating wastes (which may contain some cyanide) and Wernlund and Zunick[155] stated in their patent applied for in 1938 that ferrous sulfate treatment had been the most widely used method for disposal of waste cyanide solutions.

King and Parker[103] reported the use of copperas (ferrous sulfate hydrate) and lime for the treatment of cyanide wastes in Germany. Krause[103], in discussing treatment of wastes in Germany, noted that the use of ferrous sulfate or ferrosoferric sulfate to convert cyanides into Prussian blue was common procedure but not one which he considered the most advisable. He stated that the waste waters must be alkaline at the beginning of the process and slightly acid at the end for complete reaction, that excess iron is to be avoided, that the waste water must be neutralized after being detoxicated, and that the presence of complex metallic cyanides makes the action of the process uncertain. Because plating wastes usually contain complex cyanides, the process is being displaced by other methods. Strell[93] stated that cyanides can be removed from solution by formation of ferrocyanides, while Meinck[95] said that the use of waste waters for manufacturing Berlin (Prussian?) blue is too uncertain for practical purposes.

Denis[17] obtained a patent, for treating liquors such as those from gas manufacturing, for adding an alkali or alkaline earth metal hydrate to the waste solution together with ferrous sulfate while passing in carbon dioxide to precipitate ferrous ferrocyanide and then, after allowing the precipitate to settle, adding barium hydroxide or other reagent capable of forming a carbonate precipitate to carry down any remaining iron ferrocyanide (presumably present in colloidal suspension). Kazachkov[71] in his patent removes cyanides along with other organic materials from waste waters by heating with iron hydroxide ore, the ore being regenerated by blowing with hot air or steam.

Barnes and Brnidech[63] designed and put into operation a waste disposal plant to handle large volumes of acid plating solutions and a small volume of cyanide solutions. In the plant, as first put in operation, acid metallic wastes were passed over iron filings to reduce chromate and neutralize some of the acid; the segregated cyanide wastes were then added to produce complex iron cyanides and lime added to cause precipitation. No operating data are reported, but it is stated that there was no difficulty with cyanide in the treated effluent. In later manufacturing operations the amount of cyanide wastes increased to such an extent as to require separate treatment. Some laboratory work was undertaken[63], and it was concluded that removal of cyanide by ferrous sulfate and lime was effective but that too much sludge was produced. Data from this laboratory investigation are not reported in the paper. Treatment with ferrous sulfate was abandoned and chlorine adopted (as discussed elsewhere in this report).

Southgate *et al.*[112,87b10,89,91] found that a 40-ppm cyanide solution treated with ferrous chloride was nontoxic when diluted 100:1. This dilution ratio is rather excessive and would almost have produced a nontoxic solution without the treatment. In this particular work gasworks affluents, which also contain hydrogen sulfide, were the source of cyanide pollution. The presence of hydrogen sulfide was found to interfere with the reaction between cyanides and ferrous chloride, slowing it considerably[112]. This is due to precipitation of ferrous sulfide and production of hydrochloric acid by the reaction:

$$FeCl_2 + H_2S = FeS + 2HCl$$

Though the ferrous sulfide produced will react with cyanide, continuous stirring is necessary to achieve any reasonable rate of reaction. The acidity of the hydrochloric acid produced in the reaction is also inhibiting on the conversion of cyanide to ferrocyanide unless neutralized. Addition of lime[112,91] was found to increase the rate of reaction as did the addition of excess ferrous chloride. Dissolved oxygen was found to oxidize the ferrous ions to ferric ions[112], but in air-free solutions the conversion of cyanide to ferrocyanide was almost quantitative.

Further laboratory work carried out by Southgate *et al.*[89] working with ferrous sulfate instead of ferrous chloride led them to the conclusion that lime plus ferrous sulfate is the most useful process for treatment of cyanide wastes. Solutions of potassium cyanide, sodium zinc cyanide, sodium cuprocyanide, and mixtures of sodium zinc cyanide and sodium cuprocyanide in concentrations equivalent to from 10 to 100 ppm HCN were used. Best results were obtained when the *p*H was maintained between 7.5 and 10.5 by lime. Though removal of cyanide was incomplete with addition of the theoretical amount (no chemical equation presented in the paper to serve as a basis for theoretical amount) of ferrous sulfate, the addition of excess ferrous sulfate resulted in removal of 92 to 95 per cent of the cyanide. For example, solutions containing potassium cyanide or sodium zinc cyanide in concentrations equivalent to 100 ppm HCN required 1.5 to 2 mole proportions of ferrous sulfate per mole proportion of cyanide, and solutions of sodium zinc cyanide plus sodium cuprocyanide in total concentrations equivalent to 70 ppm HCN required 10 moles of ferrous sulfate per mole of cyanide. As an indication of the reduction in toxicity achieved, a solution of sodium zinc cyanide requiring 1000:1 dilution to become nontoxic before treatment required only 6:1 dilution after treatment.

A small-scale plant test was made over a period of two weeks using 3000 gal/day of brass electroplating wastes containing complex cyanides of zinc and copper. The waste contained 46 ppm free cyanide (as HCN) and 23 ppm complex cyanide (as HCN). Sixteen moles of ferrous sulfate per mole of total cyanide were added with sufficient lime to give a *p*H of 11–12. After treatment, free cyanide was 5.5 ppm and complex cyanide 2.6 ppm.

Eldridge[61] carried out less extensive tests and reported: "Attempts to precipitate the cyanide (from 200 ppm KCN solution) with ferrous and ferric salts were not successful because although the removal of the cyanide is appreciable it is not quantitative. The cyanide left in the solutions after the precipitate of Prussian blue was removed amounted to about 50 ppm and was still extremely toxic to fish life. This method of treatment requires accurate chemical control and is too complicated to be of practical use in cyanide waste treatment". No details are given in the paper of the conditions of experimentation.

Pure sodium cyanide solution, high-speed copper plating solution, and alkaline zinc plating solution were treated with ferrous sulfate and caustic soda by workers of the du Pont Company[b] who found it impossible to reduce sodium cyanide below 64 ppm despite several variations in procedure. Karsten[97] concluded on the basis of laboratory work that the reaction between ferrous sulfate and cyanide was not sufficiently rapid under his experimental conditions to be effective in eliminating toxicity. Gilbert[65] said that the use of ferrous sulfate is not recommended for treating cyanide solutions. Wise[160] stated that cyanide in

cadmium and nickel plating wastes can be precipitated as insoluble Prussian blue by copperas and ferric sulfate in acid solution (*p*H 2.8–4.0).

Moir and Gray[4] undertook an extensive investigation of the reactions between solutions containing from 110 to 1020 ppm KCN and ferrous sulfate in amounts ranging from 1 to 8 moles ferrous sulfate per mole potassium cyanide and at temperatures of from 1° C to 70° C (34–158° F). The effects of adding sodium hydroxide before adding ferrous sulfate and the effects of adding various bases and oxidizing agents after treatment with ferrous sulfate in neutral and basic solutions were also studied. The experimental results are reported in great detail in the paper (although the experimental conditions are not always clearly stated) but are outside the scope of this paper. We shall list the main conclusions of the authors but shall not attempt any detailed discussion of them. They were:

1. A temperature of 10–20° C (50–68° F) was found to be most satisfactory for the test conditions used. Temperatures above or below this range resulted in higher residual cyanide in the treated solutions.

2. Adding alkali to the cyanide solution before adding ferrous sulfate gave greater conversion of cyanide to ferrocyanide, but too much alkali inhibited the reaction. Each ferrous sulfate-cyanide ratio used had a different optimum alkali-cyanide ratio. For 0.01-N KCN (650 ppm KCN) solutions, 0.4 moles alkali per mole potassium cyanide plus 0.5 moles alkali per mole ferrous sulfate was found to be the optimum alkali content. This relationship held for the range of 1–0.21 moles ferrous sulfate per mole potassium cyanide.

3. The best removal of potassium cyanide obtained was 99 per cent from a 0.01-N solution. The procedure in this case was to add 1 mole alkali per 6 moles KCN followed by 2 moles ferrous sulfate. The resulting solution was then coagulated by further addition of alkali followed by magnesia and then filtered (amounts of alkali and magnesia used not stated). If magnesia were added before the alkali, residual cyanide was twice as high.

4. Various procedures were followed to analyze the treated solutions. The amount of cyanide apparently present depended greatly on the analytical procedure and it was concluded that the primary product of the reaction between cyanide and ferrous iron is an unstable compound which contains cyanide in two forms, one tightly bound and one separable by processes of oxidation.

5. Reaction is as complete in from 5 to 10 seconds as after long standing.

6. Unless alkalinity is adjusted to amount of ferrous sulfate used, an excess of ferrous sulfate gives no better results than the theoretical quantity called for by:

$$6KCN + 2FeSO_4 \cdot 7HOH = K_4Fe[Fe(CN)_6] + 2K_2SO_4 + 14HOH$$

7. Addition of ferric chloride (without addition of alkali, presumably, though not so stated in paper) hinders the reaction between cyanide and ferrous sulfate be-

It would thus appear that the use of ferrous sulfate is feasible only when careful *p*H control is exercised, when dilution capacity is available (if the treated wastes are discharged to a stream), and when the large quantities of iron sludge produced can be conveniently handled. This sludge cannot be dumped into streams because of bulk and color. The advantages of ferrous sulfate treatment followed by lime are: cheapness of reagent, lack of toxicity of chemicals added, and the fact that such treatment also successfully removes all metallic ions, including hexavalent chromium, that might be present. If the sludge problem could be overcome, this might be a very promising process particularly for small electroplating shops which produce a diversified composition of wastes.

Despite the large amount of experimental work reported on the reaction between ferrous sulfate and cyanide, the various factors affecting the reactions have not been sufficiently studied (results of different investigators apparently being in conflict) and further experimentation is needed before final conclusions can be drawn regarding the feasibility of this method of treating cyanide wastes. The evidence available at present indicates that other methods of treatment would be preferable in most cases.

Toxicity of Iron. Ellis[127] stated that 100 ppm $FeCl_3$ is not harmful to fish in hard water but that 100 ppm is toxic in soft water. Nine ppm $FeCl_3$ in distilled water killed fish in 20 hours (Powers, quoted by Ellis). One hundred ppm $FeSO_4$ in hard water is not harmful to fish (Ellis), but 2.9 ppm in distilled water is toxic (Clark and Adams, quoted by Ellis). Potassium ferrocyanide, 2000 ppm, is nontoxic to minnows and goldfish (Perry and Adams, quoted by Ellis).

Reaction of Cyanide with Aldehydes

Hydrogen cyanide and simple metallic cyanides react with aldehydes and ketones to form addition products known as cyanohydrins. The reaction between formaldehyde and hydrogen cyanide to yield formaldehyde cyanohydrin (glycollonitrile) may be expressed as follows:

$$CH_2O + HCN = HOCH_2CN$$

Some discussions of these reactions were given by Williams[711] and Walker[686]. A solution containing a cyanohydrin which is allowed to stand at room temperature will undergo hydrolysis to yield ammonia and various other products such as glycolic acid, glycine, diglycolamino acid and triglycolamino acid.

The Romijn[650] method of formaldehyde analysis consists of adding an excess of potassium cyanide to a solution containing formaldehyde, the reaction being carried out in dilute solution at room temperature for a few minutes and the unreacted cyanide being determined by titration with silver nitrate or other means. The reaction is reported to be quantitative and not affected by the presence of acetone, acetaldehyde, benzaldehyde, or higher aldehydes and ketones. Jones[419] studied the equilibria for reactions between hydrogen cyanide and acetone and between hydrogen cyanide and acetaldehyde in dilute solutions and found that at 25° C (77° F) the ratio of the product of the equilibrium concentrations of hydrogen cyanide and acetaldehyde to the concentration of cyanohydrin was 0.00718 gram moles per liter of solution. The corresponding value for the acetone-hydrogen cyanide reaction was found to be 0.0795. Thus a solution containing 0.1 mole acetaldehyde per liter and 1.0 mole hydrogen cyanide per liter initially will form cyanohydrin to the extent of 76.6 per cent at 25° C.

If the results of Jones are correct and the statement concerning noninterference of acetaldehyde and acetone in the Romijn analysis of formaldehyde is also correct, then it might be concluded that reaction between formaldehyde and potassium cyanide is much more rapid than between hydrogen cyanide and higher aldehydes and ketones. It might also be concluded that equilibrium for formaldehyde reactions with cyanides is far more towards complete reaction than in the case of other aldehydes or ketones with cyanides.

White[781] reported on the basis of laboratory experiments that potassium cyanide and formaldehyde react quantitatively and almost instantaneously in the cold. He stated that 99.5 per cent of the reaction takes place immediately but that 12 to 16 hours are required for completion of the reaction.

Southgate *et al.*[115,69,70] found that formaldehyde readily destroyed the toxicity of solutions of pure potassium cyanide in concentrations up to 10 ppm CN. These workers also reported that treating wastes (from a gas cooler) containing 40 ppm cyanide as HCN with a small quantity, but about 150 times the theoretical amount, of formaldehyde produced a nontoxic solution when diluted 100:1. There is no indication that smaller dilution ratios were tried. The dilution of 100:1 and the excess ratio of 150 for formaldehyde are not conditions which would be very practical. In this same investigation[115,70], 283 samples of river

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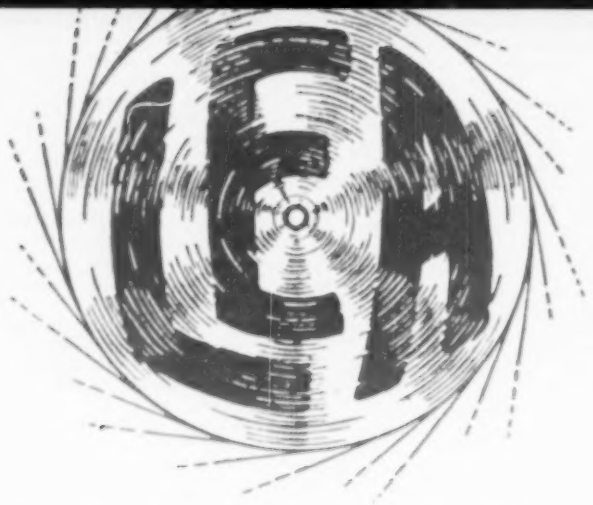

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water polluted with gas works effluents were obtained. Of these, 138 were toxic to trout. Treatment with formaldehyde rendered 130 of the toxic samples nontoxic to trout while 8 samples were still toxic (either because of excess formaldehyde or phenols from the gas works effluents). The remaining 145 samples were nontoxic and treatment with formaldehyde left 140 still nontoxic but rendered five toxic.

In some other laboratory work[6] it was found that a sodium cyanide solution could be reduced to essentially zero cyanide content by adding 80 per cent excess formaldehyde solution. When all the formaldehyde was added at once to a 1 lb/gal sodium cyanide solution, the solution boiled and the cyanide concentration was reduced to 35 ppm in an hour, 15 ppm in a day, and 0 ppm in a week or less. The cyanide in a sodium-copper cyanide solution was reduced from 185 g/l to 25 g/l in a week by this method. This latter result would indicate that complex cyanides do not react so readily with formaldehyde as do the simple cyanides.

It is thus seen that there are not sufficient experimental data available to evaluate the use of formaldehyde with waste cyanide plating solutions. The effects of *p*H, type of cyanide, temperature, and other variables on the degree of completion and the rate of reaction are unknown.

Toxicity of Formaldehyde. Southgate *et al.*[113] reported that concentrations of formaldehyde above 40 ppm are toxic to fish.

Ion Exchange

The use of ion exchange to concentrate cyanide wastes might be of value in certain cases. Sussman *et al.*[68] reported the removal of iron as ferrocyanide from solution using an anion exchange resin chloride with subsequent recovery of approximately 97 per cent of the ferrocyanide. Though the emphasis of Sussman's work was on the removal of iron, yet his results are significant in our present investigation as they represent the only successful attempt reported in the literature of handling cyanide compounds in ion exchange.

Bloodgood and Lawson[681] using an anion exchange resin with a 15 to 24 ppm KCN solution of *p*H 6.1 to 6.4 succeeded in obtaining an initial removal of KCN to 4–6 ppm, but this residual concentration of potassium cyanide increased rapidly with continued passage of solution through the bed. The use of a cation resin and an anion resin in series reduced the cyanide content of a solution from 20.4–24.7 ppm KCN to less than 1 ppm for the first 7 liters of solution passed through 150-ml beds of resin. The cyanide solution was made up with distilled water and had a *p*H of 6.8 before entering the cation bed. The *p*H of the solution leaving the cation bed and entering the anion bed was 3.3 to 3.8. This is sufficiently acid to allow the release of hydrogen cyanide—though there was no appreciable loss of cyanide in the cation bed. The effluent from the anion bed had a *p*H of 10.5 to 8.5. An actual zinc plating waste containing 27.7 ppm CrO_3 and 51 ppm KCN with *p*H of 7.95 was then passed through cation and anion resin beds 800 ml in size, and the KCN content thereby was reduced to 5–15 ppm. A second waste containing 53.1 ppm CrO_3 and 17.3 ppm KCN was reduced to 0.5–2.5 ppm KCN by similar treatment.

The experiments of Bloodgood and Lawson are not broad enough in scope nor sufficient in quantity to furnish a basis for any quantative conclusions. It would appear that under certain conditions of operation an appreciable reduction in cyanide content can be achieved and that further experimentation might disclose conditions under which substantially all the cyanide could be removed by ion exchange.

Dobson (by letter) informs us that, in the discussion which followed the presentation of Bloodgood and Lawson's paper, the authors stated that cyanide could not be regained from the resins by regeneration and that the absorption capacity of the bed was reduced linearly with the amount of cyanide that had passed through it.

A new resin, Amberlite IRA–400, has recently been announced[711b,c] and the claim made that it will absorb cyanide from solutions of *p*H less than 10.

It might be pointed out that ion exchange is not a means of disposing of wastes but only a means of concentrating wastes. The use of ion exchange would be of use where water is difficult to obtain and recycling of water is desirable or where small residuals of cyanide, either in final rinse waters or in effluents from a treatment process, need to be removed. The concentrated cyanide could then be treated by one of the processes already discussed. Ion exchange resins represent a large capital investment and regenerating chemicals must be used.

Choice of Particular Process

In designing a waste treatment plant one must know the volume of the waste liquor and its chemical characteristics as well as the chemical characteristics acceptable in the treated effluent before adopting a specific method of treatment. There are of course other factors to be considered also, such as location of plant,

TABLE V. WASTE ANALYSES REPORTED IN VARIOUS REFERENCES

Data	Reference No.								
	681	403	403	403	403	628	684	683	683
Gal/day	15,000					400,000	50,000		
*p*H	9.4	2.7	6.2	3.0	1.8–3.2		7.7	7.95	7.5
CN, ppm	129	1.1	0.8	12	0.0–22.4	0.1	2	20	6.8
Carbonate, ppm $CaCO_3$	220					117		335	315
Bicarbonate, ppm $CaCO_3$	332							360	376
Cu, ppm		7.1	2.0	32	0.2–34	0.5	3		
Zn, ppm		6.8	2.1	2.3					
Cd, ppm							10		
Fe, ppm	2.25				0.0–80				
Cr, total, ppm		4.1	18.1	87	87–643	2.0	100	27.7	53.1
Cr, hexavalent, ppm		3.5	16.6	76	75–636			27.7	53.1
Ni, ppm		0.1	0.14	2	trace–6.4	0.3			
SO_4, ppm		215	65	271	84 –769	44.0			
Cl, ppm						16.0			

existing facilities, availability of steam, acid wastes, etc. We have already discussed the factors determining what is acceptable or unacceptable in a treated effluent. Table V gives compositions and in a few cases the volumes of some wastes reported in various references.

Dobson[65] gave the following ranges of cyanide content for various types of waste.

Plating rinse water	1 to 25 ppm
Dumped plating baths	10 to 100,000 ppm
Heat-treating quench waters	50 to 100 ppm
Coke-oven-gas scrubbing water	150 to 300 ppm
Mine tailing rinses	5 to 25 ppm

Data in this field are very limited and Table V presents substantially all the published information. It is clear that these data are wholly inadequate as a basis for choice of a treatment process.

It is also apparent from the above that there is no such thing as a typical cyanide waste. Even in the same plant there can be large fluctuation in concentration as well as in composition. It follows then that a treatment process must be flexible enough to handle the variations to be expected in any particular waste. The extent of these variations depends upon procedures used in the specific manufacturing plant and must be individually determined.

Keeping these factors in mind, it would appear from our review of the literature that treatment of cyanide plating wastes with sulfuric acid followed by aeration, and treatment with chlorine in alkaline solution are probably equally satisfactory and applicable to most cases. Small plants might find the lime-ferrous salt treatment or the use of lime plus hypochlorites to offer some advantages. The disposal of wastes into sewer systems after precipitation of metals with lime may prove satisfactory in many cases, and in special cases simple ponding may be quite satisfactory. Further study given to the use of formaldehyde as a treating agent and to the use of acid gases for displacing hydrogen cyanide as a gas might show advantages in these processes for certain applications.

In the field of waste treatment as in other chemical operations the use of pilot plants is advisable. In many cases a pilot plant carefully studied over a period of some months will provide information which may change the size of a proposed plant or even the basic treatment process to be used. In time it may be possible to design a treatment plant without the intermediate pilot plant stage but at present to do so in many cases may result in excessive costs.

Summary and Conclusions

1. The results from several investigations of the toxicity of cyanides towards fish life have been reported in the literature. The interpretation of these results for the purpose of establishing maximum concentrations of cyanide acceptable in streams or in treated wastes is a complex problem dependent for satisfactory solution upon knowledge of such factors as type of fish, other substances present, time of contact, and environmental influences on the stream. Each case of waste disposal to a stream thus becomes a problem of evaluating the quantitative effects of the factors with respect to the particular stream involved. It would appear from the published results that concentrations of less than 0.01 to 0.02 ppm CN in a stream would be acceptable in most cases and that in some cases concentrations of 0.5 pp, or even more, might be tolerated. The cyanide content allowable in a waste would range from these values to various multiples of them depending upon dilution ratios existing.

The effect of cyanide upon the operation of sewage treatment plants has also been investigated. The permissible cyanide content of sewage seems to be much higher than of streams. Perhaps as much as 3 ppm CN can be tolerated in sewage and the amount in the waste may be higher depending upon the dilution ratio.

It is to be noted that other cyanogen compounds such as the complex cyanides, cyanates, and thiocyanates are much less toxic than the cyanide ion and this fact is utilized in several treatment processes.

We have made no study of the actual requirements set up by local agencies regarding cyanide contents allowable in treated wastes. We have been told that the State of Michigan is considering a maximum concentration of 0.1 ppm CN in a stream and 1 ppm in the wastes discharged to a stream. It is well to point out in this regard that needless stringency in setting up such requirements can easily lead to unreasonable costs for waste disposal. It cannot be too strongly emphasized that each disposal problem is a special problem and requires intelligent application of general rules rather than blind application of procedures arbitrarily decided upon—if the desirable goal of pollution abatement is to be achieved without undue economic burden being imposed upon industry.

2. Segregation of wastes prior to treatment is generally desirable since it usually leads to a simplification of the disposal problem. The most obvious segregation to practice is that of separating concentrated from dilute wastes. In some cases the dilute waste could be discharged without treatment or at least given a simple and cheaper treatment than strong wastes or a mixture of the two would require.

3. Dilution, although the simplest of all the methods of treatment and therefore the most desirable from the standpoint of the plater, is of quite limited applicability. Due to the high toxicity of the cyanide ion, the volume of diluent required would be very high and in most cases higher than would be available.

Furthermore, the use of this method depends on proper control of the release of the waste to avoid temporary locally high concentrations, and such control is not easy to insure under all conditions.

4. Complete evaporation to dryness has been considered as a means of disposing of the concentrated wastes and may have some merit for small plants. No chemicals are required and the solid residues would be of small volume. Means would have to be provided to vent noxious gases.

5. Acidification of the waste and volatilization of the hydrogen cyanide as a gas is now practiced at several large plants. This may be objectionable if the gas must be released in a settled locality but the supposed danger is probably more psychological than real as the use of a high stack plus reasonable dilution by air should eliminate any hazard. Available data indicate that the maximum permissible concentration of hydrogen cyanide in air is higher than for such common gases as chlorine, formaldehyde and sulfur dioxide. Hydrogen cyanide is not a cumulative poison so that small increments absorbed from air below the toxic limit will not be harmful. One method of avoiding entirely any question of the toxic effect of hydrogen cyanide in discharged gases is to burn them. This might be done either in an existing furnace or one specially constructed for the purpose. There exists the possibility of adsorbing the hydrogen from the air by active carbon or silica gel and then removing it in a concentrated form by distillation. Such a procedure would be useful only if the cyanide were to be recovered. It seems doubtful if recovery of the volatilized hydrogen cyanide will be feasible except possibly in a few large installations.

Sulfuric acid is the reagent usually used to decompose the cyanides, and the solution is then either blown with air or heated by direct steam to release the hydrogen cyanide gas. A brief description has been given of some plants operating this process. Acid gases such as carbon dioxide and sulfur dioxide have been used in processes to reclaim cyanides from ore processing wastes and might be applicable to treatment of plating wastes. The use of a flue gas, for example, would avoid the purchase of any special reagent and the difficulties involved in handling sulfuric acid. These advantages must be weighed against a probable greater cost and complexity of equipment for a process using an acid gas to displace the hydrogen

cyanide. Furthermore, it is probable that a much larger excess of the reagent would have to be used to obtain a comparable reduction of cyanide than when sulfuric acid is used.

The method of hydrogen cyanide evolution appears to be applicable to all types of cyanide wastes but quantitative data on this general process are very limited and it is difficult to predict how the process would be applied to any specific case. For example, authorities are not in agreement on the extent to which cyanide can be removed by this method nor is it very clear to what extent cyanide remains combined in the residue in any particular case. Practically the only scientific investigation reported in the literature is that of Eldridge in 1933 and only a limited range of variables was studied.

6. The conversion of cyanide ion to insoluble cyanides of such metals as zinc, copper, or lead is a method of treatment that has been tested on a laboratory scale but holds little promise. The treating agents are relatively expensive and the removal of cyanide ion is not very complete.

7. The formation of insoluble iron ferro- or ferricyanides by treatment of cyanide wastes with lime and iron salts such as copperas (hydrated ferrous sulfate) is a process that seems to have been practiced extensively abroad but is little used in this country. Only one installation in this country, later abandoned in favor of the chlorine process, has come to our attention. Few quantitative data are available for this process and the effect of a number of factors is unknown. For example, it is not clear how the process operates when complex cyanides are present; there are few data on the limiting concentrations of residual cyanide ion that can be reached, on the excess of reagents required, or on the character and volume of the sludge produced. These and many other pertinent facts need to be known before even a preliminary evaluation of the process can be made. General, descriptive statements about the process are conflicting—some claim the process to be a useful one and others claim it to be of doubtful value. Further experimental work needs to be done with the object of resolving these conflicting statements.

8. The oxidation of the cyanide ion to the much less toxic cyanate in a strongly alkaline solution (*p*H of 8.5 or above) is a method that is coming into wide use in this country at the present time. Many oxidizing agents can be used and have been tested, but chlorine is probably the most satisfactory and the cheapest. It can be used either as elemental chlorine fed to the solution as a gas, or as a solution of chlorine in water, or in the form of a solid hypochlorite. Methods of controlling chlorine gas addition by oxidation-reduction potential measurements had already been well developed for use in the treatment of drinking water. The reaction can be carried beyond the cyanate stage to the formation of carbon dioxide and nitrogen, but this requires a much larger amount of the oxidant, is a much slower reaction, and it is doubtful if it is necessary in most cases.*

This method appears to be applicable to almost all types of cyanide wastes, but when chlorine is the oxidizing agent it does not appear feasible to use it on silver wastes because subsequent recovery of the silver is difficult.

Most of the plants now operating this process use a batch treatment but at least one continuous chlorine process is said to be in operation. For small establishments bleaching powder or other hypochlorites might prove to be simpler to use and cheaper to apply than chlorine though the volume of sludge produced might be greater (depending on the dilution) if bleaching powder were used.

The oxidation to cyanate is relatively rapid and easily reduces the CN^- content to 1 ppm or less. *p*H is a critical factor but the variables which affect the proper value to use for a particular waste are not known. Values of from 3 to over 8.5 are used in practice. Failure to recognize the importance of *p*H retarded the development of the process for a number of years.

The other metals present in the complex cyanides will be precipitated as sludges which must be disposed of. Possibly some recovery of these metals might be feasible, particularly if dried sludge from a number of plants were sent to a central recovery plant.

9. Electrolytic oxidation of the cyanide with simultaneous plating out of some of the metals has been applied in at least two instances. It does not appear to us to hold much promise of being developed into a practical process for treatment of other than concentrated wastes. In circumstances where dilute wastes can be disposed of in a sewer or by simple dilution it might prove feasible to electrolyze the concentrated wastes. Other factors might also favor the treatment of concentrated wastes by electrolysis even though the dilute wastes would have to be treated by a different process.

10. The use of polysulfides—the so-called lime-sulfur process—to treat cyanide wastes by forming the less toxic thiocyanates has been tested but found to be not very satisfactory. In the first place the reaction is slow and not very complete in a reasonable time and secondly there will be a liberation of poisonous and malodorous gases (notably hydrogen sulfide) if the treated liquor subsequently comes in contact with acid or with chlorine. By adding the thiocyanate itself though less toxic than cyanide is still relatively toxic. It is also to be noted that the process is applicable only to concentrated wastes.

11. The reaction of formaldehyde with hydrogen cyanide and alkali cyanides has been given some consideration as a basis for a treatment process. The published results have been only on pure hydrogen cyanide or alkali-metal cyanide solutions and are too incomplete to furnish a basis for evaluating such a process. The reaction is reversible and a large excess of reagent might be necessary in some cases.

12. Only a very little work has been done on the use of ion exchange materials for treating cyanide wastes. It is too early to draw any conclusions about the feasibility of this method but results so far are only mildly encouraging. It should also be emphasized that ion exchange is essentially a concentrating process, that is, it converts a dilute liquid waste into a more concentrated one. The problem of disposal still remains, but, of course, the concentration may be a very desirable step.

13. The plating waste problem is complicated by the great variation in size of plants producing the waste, in the composition and in the volume of the wastes. Even in a given plant the composition and volume are apt to vary in an unpredictable manner with time. Furthermore very few plants have accumulated many data on these two important factors. Data of this kind are an absolute necessity before recommendation of a treating plant can be made intelligently. Where there is a considerable variability with time in a given establishment, a batch treatment process is to be preferred because of the greater ease with which it can be adapted to meet changing conditions.

The fact should also be kept in mind that there are often two wastes, the strong spent baths and the dilute rinse waters. The methods of treatment applicable to them may be entirely different. For example, most of the processes discussed in this review are not very suited to the treatment of the dilute wastes. It is seldom made clear in the literature what the limitations of a given process are, but we would infer that perhaps only the chemical oxidation process (excepting dilution of course) is feasible for the treatment of dilute wastes.

14. The main objective of a treatment process is the prevention of pollution

*Since writing the above, we have been informed that it is not possible to stop the reaction in a batch treatment with the formation of cyanate and that the usual practice is to destroy cyanate also.

rather than the recovery of valuable materials. The question of recovery should not be lost sight of, but it is seldom that it will be economically feasible to attempt recovery. A notable exception to this statement occurs in silver plating where primary consideration is given to the recovery of silver[85]. In some cases recovery of the water for reuse may become an important objective of the treatment process.

15. One fact which clearly emerges from this review of the literature on the treatment of cyanide wastes is the great dearth of quantitative data on all of the processes proposed or even those actually in use. What few data have been given are for a very limited set of conditions, and frequently the conditions are not clearly stated so that it is impossible to generalize the data and apply them to other conditions. There is need for a systematic study of the variables such as concentration and composition of the waste solution, temperature, *p*H, excess of reactant, etc., on the degree of completeness of the main reaction and its relation to time, on the extent of side reactions, on volume and character of sludge produced, and on other factors.

As a concrete illustration of the lack of fundamental data referred to in the preceding paragraph, consider the ferrous sulfate-lime treatment process. There is great disagreement among the results of different workers over some of the most elementary facts such as the residual cyanide that it is possible to achieve. Presumably this disagreement is due to the somewhat different sets of conditions used by the investigators, and the lack of systematic data makes it impossible to bridge the gaps between them. To consider one more point—there is frequent mention of the sludge produced in this treatment process but no data whatever on the volume of this sludge, its settling or filtering characteristics, and how these things are affected by some of the common variables.

Even in the case of the two better known processes, namely, chlorination and volatilization of hydrogen cyanide, the published quantitative data are so meager in extent that one cannot predict with any degree of assurance what the result will be under any particular set of conditions.

16. No radically new methods of treatment, other than ion exchange, appear to be in the picture and we believe that progress in the immediate future will be made by more intensive investigation of the known processes along the lines suggested here and by improvements in equipment and in process control.

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A. E. S. Research Report Serial No. 14, a reprint of this article that began in the May issue, will be available this month.

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——readers' questions of general interest——

Q. 51. We wish to learn something about comparative costs of electroplating aluminum and other metals. We know that electroplating costs are dependent upon many factors, such as form of the metal to be plated, quantity, size of shop, locality and plating methods, and that it would be too much to expect that you would have data covering costs of plating a particular part which has been made from various types of metals. It would be a great deal of help, however, if you could help us obtain approximate plating costs for the various metals.

A. There are too many variables to attempt to give absolute plating costs and our remarks, therefore, will necessarily be confined to relative costs.

We estimate that the cost of actual plating upon aluminum is from 10 to 20 per cent higher than the cost of plating upon steel, copper, or zinc base die castings. These added costs come from the two extra dipping operations that are required when aluminum is electroplated as well as the cost of the zincate solution. The cost of applying the zinc coating using proprietary solutions is approximately 0.3 cent per square foot of surface area treated. Inasmuch as two additional plating operations are required for plating upon aluminum over plating upon the other metals mentioned and there are about 10 steps in the normal plating procedure for the other metals, the added cost of handling would range from 10 to 20 per cent. Actually, however, the increased cost of plating upon aluminum may not be this great because aluminum is considerably easier to polish and buff to a good luster than are some of the other metals.

If the article is to be exposed to outdoor weather, aluminum as a base would be considerably more expensive if the same degree of corrosion resistance is wanted inasmuch as heavier coatings must be applied to aluminum than to steel, copper or brass to obtain the same corrosion resistance. For objects to be exposed to mild atmospheres, such as indoor, this additional thickness of coating is not required.—WALTER R. MEYER.

A. One of the important items of the total finishing cost is that of labor. Hand polishing and buffing frequently cost more than all other processing together and hence the ease of carrying out these operations may have a big effect on cost. In full-automatics designed for the job at hand, the length of a polishing or treatment step or the addition of such steps affects the cost of equipment and space and of material used, but if the machine is old and has to be slowed down, the labor cost per piece is likely to rise. The lighter weight of aluminum may reduce cost of labor for loading and unloading of tanks, automatic machines, and tumbling barrels. For clarification of the factors involved in buffing we refer to you the papers by Miller & Du Rose and Cupps & Graham in the A. E. S. Proceedings, 1947. Similar factors are involved in polishing.—K. G. SODERBERG.

Q. 51. With the introduction of a new batch of anodes into a bath containing 34 oz/Imp. gal of copper sulfate ($CuSO_4 \cdot 5H_2O$), 9 oz/Imp.gal of sulfuric acid and 2 oz/Imp.gal of alum the copper deposits crack and peel from the silvered cellulose acetate gramophone master and much sludge forms at the anode. Chemical and spectrographic analyses show very little difference between these and the previously used, satisfactory anodes. The hardness of good and bad deposits is 100–120 D. P. H. N. Addition of 1.25 ml/gal-day of 100 vol. hydrogen peroxide obviates the trouble. What is the cause?

A. The difficulty sounds like organic contamination. Take a sample of the bath and deposit 0.01–0.02 inch on a lead cathode and strip it. If it is brittle, treat the sample with activated carbon, filter it, and make a new deposit. If this is ductile, the contamination with organic impurities is proven and the whole bath should be carbon treated. Continuous treatment may be required until the source of the organic material has been determined.—The structure of the copper anode may well affect the amount of sludge formed. Sludge is best controlled by means of the diaphragm set-up described on pp. 203–213 of the 1948 Proceedings of the American Electroplaters' Society.—H. L. PINKERTON.

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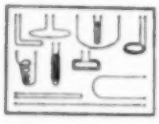

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Book Review

DR. HAROLD J. READ

Associate Professor of Metallurgy, Pennsylvania State College

METALLISCHE UEBERZUEGE by Eugen Werner, 3rd edition, 1946, 187 pages. Carl Hanser, Leonhard-Eck-Strasse 7, Muenchen 27, Germany. Price, 5.50 DM.

American electroplaters will find very little in this German book that is likely to prove helpful in modern practical plating. The solutions, techniques and plating conditions which are given are, for the great part, outdated, and there is nothing typical of modern practice which is not better described in any of several books on metal finishing published in the English language. Since the book is one of a series appearing under the general title of "Werkstattkniffe", i. e., workshop tricks (or hints), one would expect to find considerable material on shop practice, but aside from a few items such as a short discussion of quite ordinary racking methods, there is nothing much other than a recital of bath compositions and somewhat rambling discussions thereof. There is a complete absence of useful theoretical material.

Although the title refers to "metallic coatings", the text is confined to electrodeposition, anodic oxidation, phosphating, and metal coloring. Rather long chapters are devoted to nickel, chromium, and copper, but all of the remaining metals are disposed of in 30 pages. In most cases a number of bath compositions are given for each metal. There is, however, very little critical comment as to the relative merits of the various baths and the fields of usefulness for each (this might be difficult for some of them!) Data as to operating conditions, even for such important variables as current density, temperature, and *p*H, are often omitted. Of some interest are a few passages on trouble-shooting where various plating defects are correlated with bath composition or operating variables.

A few pages at the end of the book are devoted to descriptions of specialized items of equipment for production processes, e. g., polishing barrels, automatic cleaning lines, and pickling equipment. They do not form an organized chapter, and appear to have been tacked onto the text as an afterthought. There is nothing in these pages which should be new to a well-informed American reader.

Although there are 65 figures in the text, a fairly large fraction of them are half-tones which are either of such poor quality or so small as to be of little use.

Any book which is intended to be used as a shop handbook should have a good index, but here this feature is quite inadequate. Although the book is fairly well printed aside from the figures, it is cheaply bound in paper.

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Article Abstracts

For copies of original articles, turn to your Public Library for photostats or addresses of the publications in question

The Estimation of Cobalt in Bright Nickel Plating Solutions. H. D. Carter. J. Electrodepositors' Tech. Soc. **24**, 27–31 (1949).

Description of a new method of determination of cobalt in bright nickel plating solutions of the cobalt sulfate-formate type, an adaptation of the Dickens and Massen method for the estimation of cobalt in steels calling for a potentiometric titration with potassium ferricyanide, using platinum and saturated calomel electrodes, and a *p*H meter. The meter is found to be very accurate and remarkably free from interference, and has been proven in routine analysis for over eighteen months. An experienced operator can carry out a titration in less than five minutes.—LYMAN B. SPERRY.

The Chemical Colouring of Metals: Some Reactions Involving the Slow Liberation of Sulfur, Selenium, and Tellurium. M. C. N. Holt and A. M. Ward. J. Electrodepositors' Tech. Soc. **24**, 33–39 (1949).

An investigation of the series of colors produced on copper, brass and type metal by simple immersion in different solutions of sodium thiosulfate and lead acetate plus an organic acid; thiosulfate and copper acetate plus citric or hypophosphorous acid; thiosulfate and lead acetate plus acetaldehyde, formaldehyde, or acetone. Combinations of selenious oxide and tellurium dissolved in nitric acid were also tried with some measure of success. Depending on time of immersion (1 to 360 minutes), a series of colors was obtained, e. g., golden, red, deep blue, light blue, grey-green, pale red-grey, red-grey. Experiments were carried out at room temperature. Protected by lacquer, the colors seem to be permanent.—LYMAN B. SPERRY.

Protection of Steel by Tar-Aluminum Paints. P. Peissi. Office Tech. Utilisation Acier, 1947. J. Iron and Steel Inst. **159**, 98 (1948). Brit. C. A. **BI**, 718 (December, 1948).

Sections of a steel archway were coated with concentrated or dilute tar solutions and afterwards sprayed twice with tar solutions containing aluminum paint, at varying distances and varying intervals. Tabulated results of examinations made after 1, 4, 5, and 10 years show that the paints have excellent protective properties.

Chemical Brightening of Aluminum and Its Alloys. V. F. Henley. Sheet Metal Inds. **26**, 382–384 (February, 1949).

A brief description of the new "Alpol" bright dipping

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process, including surface preparation, some of the alloys used, reflectivity, and a few applications. The brightest finishes are produced on high-purity aluminum.

Prime Coating Aluminum Sheet. Clyde St. John. Iron Age **163**, 42–45 (January 13, 1949).
A short description of Permanente Metals Corporations' use of a vinyl-butyral resin pigmented with zinc chromate for coating sheet and coils as a surface preparation for painting or other finishing.

Polarographic Method of Control of Electroplating Baths. III. D. A. Vyakhirev. Zavodskaya Laboratoriya **13** (1947); Henry Brutcher, Altadena, Calif., Technical Translation No. 2088.
Development of a polarographic method for checking sulfate-containing electroplating baths by means of stationary electrodes of inexpensive metal; data on preparation of lead electrodes of a design best suited for use in plating rooms, etc.; polarographic setup proposed; procedure for amperometric titration of sulfates in solutions, particularly in nickel plating baths; reproducibility of results.

Chromium Plating of Cutting Tools. E. I. Feldshtein *et al.* Stanki i Instrument **18**, No. 4 (1947); Henry Brutcher, Altadena, Calif., Technical Translation No. 2122.

Suitable anode designs for different cutting tools are presented. Basic chromium plating practice used in study, with three variants (different current densities, plating times, and bath temperatures), are tested on basis of cutting tests run on chromium-plated tools. Results of tests include optimum plating conditions, best thickness of plate, best way of eliminating hydrogen brittleness, best initial current density, tool faces to be plated or left unplated. Advantages of electropolishing over mechanical grinding and polishing for surface preparation are set forth, with data on best electropolishing bath composition and practice for different steels.

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By GEORGE B. HOGABOOM
Consultant, New Britain, Conn.

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No. 2,465,608, March 29, 1949—Method of Producing Copper-plated Culinary Vessels—A. C. Scarullo, assignor to V. K. Scarullo, F. Scarullo, Charles Scarullo, M. S. Scarullo and M. S. Scarullo Scott.

According to this invention copper has been successfully united to the sides as well as to the bottom of a stainless-steel vessel without any danger of having the copper tend to peel off. Specifically this is accomplished by the interposition of a layer of ordinary steel to which the copper is adapted to adhere better than it does to the stainless steel.

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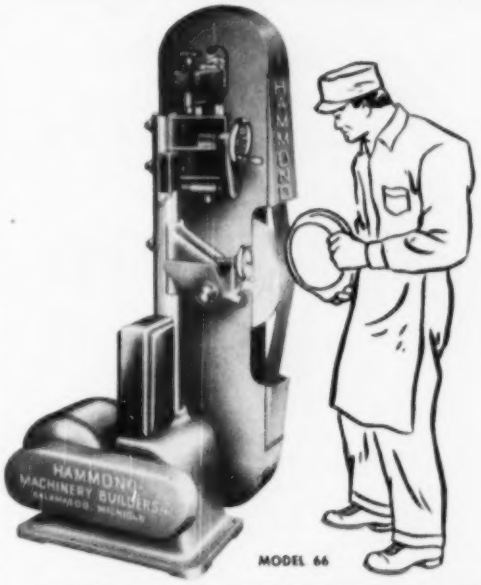

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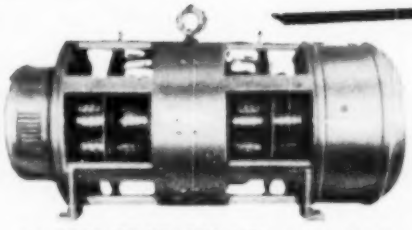

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layer of mild steel and an inner layer of stainless steel with a protective material for preventing electrodeposition on such surface, supporting said partially formed vessel for vertical axial rotation, by means also providing electrical contact to the stainless-steel surface by way of soldered joints, in a copper plating bath containing a small amount of sulfuric acid, and passing electrical current through said vessel by way of said soldered joints, while rotating the partially formed vessel by way of said soldered joints and electrodepositing copper onto the mild steel surface to achieve said outer surface of copper while precluding electrodeposition on said inner stainless-steel surface.

3 claims, 3 figures.

References cited: U. S. Patents 193,204; 415,024; 586,171; 1,514,793; 2,363,973. "Principles of Electroplating and Electroforming", by William Blum and George B. Hogaboom, 2nd ed., 1930, pp. 180, 198, 199.

No. 2,465,747, March 29, 1949—Apparatus for Electroplating Metal—L. Pessel, assignor to Radio Corporation of America.

In accordance with my present invention, the adherence of gas bubbles and particles in the plating bath to the surface of the cathodic deposit is effectively prevented by substantially evacuating the air space above the plating bath and maintaining the electrolyte at a pressure below atmospheric pressure while electrodeposition takes place. I prefer to use a vacuum of the order of two to five millimeters of mercury, although higher or lower pressures may be employed. The choice of the pressure may be influenced by the vapor pressure of the bath which, in turn, is governed by the bath temperature. The complete electrolytic system or apparatus is, of course, substantially fluid- or air-tight.

CLAIM. In electroplating apparatus for electrodepositing metal, the combination of a fluid-tight receptacle containing an aqueous electroplating solution, an anode therein, and a cathode therein to which the work to be plated is connected, means including a vacuum pump and a duct having an inclined portion connecting said pump to said receptacle for maintaining the interior of said receptacle at a pressure lower than atmospheric pressure, whereby (a) to enhance removal from said work of any gas liberated from said electrolyte during the plating operation, and (b) incidentally to enhance evaporation of water from said electrolyte, and means within said duct for cooling said inclined portion of the duct for condensing the evaporated water in the duct and returning the condensed water flowing back through inclined portion of the duct to said electrolyte whereby to maintain the quantity of water in said electrolyte substantially constant.

1 claim, 1 figure.

References Cited: U. S. Patents 692,688; 742,442; 1,597,231; 1,838,666; 1,965,813; 2,044,742; 2,229,077; 2,439,491. British Patent 20,716. German Patent 156,800.

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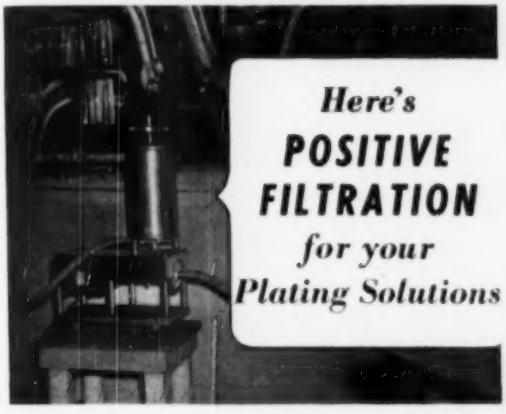

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Barrel Gold Plating

EDWARD A. PARKER

Technic, Inc., Providence, R. I.

Through an error the following Table I was omitted from the article published in the May, 1949 issue.

TABLE I. COMPOSITION AND OPERATING CONDITIONS OF BARREL GOLD SOLUTION

Material	Concentration*		
	g/l	dwt/gal	oz/gal
Gold, as cyanide complex	0.3–0.8	0.75–2.0	
Alloying metal, as cyanide complex		to color	
Free sodium cyanide	30.0		4.0
Disodium phosphate, $Na_2HPO_4 \cdot 12H_2O$	22.5		3.0
Brightener	5 ml/l		.6
Temperature	80–120° F		
Tank voltage	5–6		
Apparent current density	2–3 asf		
Plating time	2–8 minutes		

*Due to the numerous gold salts available and the innumerable methods of expressing concentrations (troy and avoir. ounce, pennyweight, grain, and variable gold content of the salts), it is the opinion of the writer that the *metal ion concentrations* only should be given and that they be best expressed in grams per liter.

1948 Proceedings

Sixteen papers and four A.E.S. Research Annual Reports on physical properties of nickel deposits; stress in deposits and its effect on thickness determination; judging the quality of plated parts; measurement of porosity of deposits; oxidation of trivalent chromium in chromium baths; bright barrel plating of nickel and zinc; high-speed "bronze" plating; plating on plastics; strip plating evaluation; electroplaters' metals of the future; copper plating without roughness; simple test for surface cleanliness; electropolishing; engineering planning in the plating department; cost finding and estimating; phosphatization of steel; and conveyorized spray finishing.

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Generators

(Continued from page 721)

reservoir to reduce frequency of needed inspection and oiling.

The new bearing design (Figs. 9 and 10)* represents a departure from the conventional type of design which

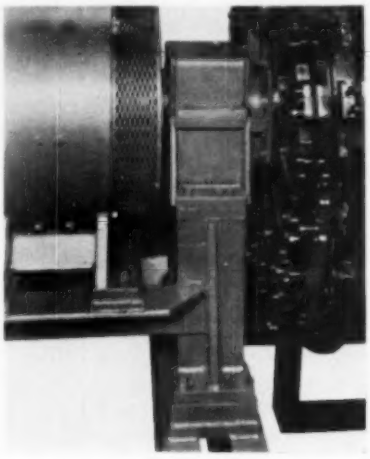

Fig. 10. One-to-one type of bearing operates at lower temperature for longer life

has been used for a large number of years. The accepted standard was to make the bearing length 2½ times the shaft diameter. After a great deal of experimenting, the optimum ratio was found to be 1:1; in other words, the length of the bearing is the same as the diameter of the shaft-journal. Along with this change came the revolutionary idea to eliminate the oil grooves in the lower bearing half, which for a great many years had been recognized as falling far short of giving perfect lubrication. The new bearing design incorporates a pressure or squeezing action which forces the oil down into the bearing between the bearing surface and the shaft journal.

Following the line of reasoning that the automotive companies have used for a great number of years, the heat-dissipating capacity of the new bearing was greatly increased by reduction of the thickness of the actual bearing material and provision of a more perfect bond between the bearing material and the outer steel shell. This is accomplished by electrolytic tinning of the inside of the bearing shell before the bearing material is poured.

With these major changes in design, the new bearing will operate at an average temperature rise of about 11° C as compared with 40–60° C with the older type bearings. This mute evidence of perfect lubrication and heat dissipation assures bearing life many times that of previous standards and freedom from costly shutdowns due to bearing failures.

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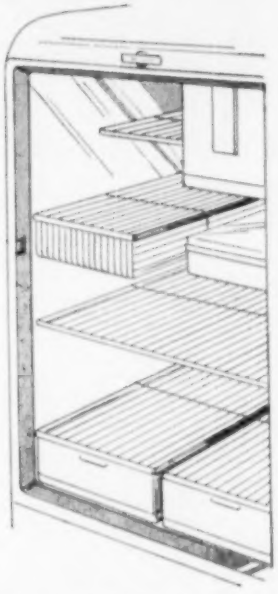

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Equipment and Supplies

E—298. Tumbling Barrel—A multiple tumbling and burnishing barrel unit is being manufactured and marketed by the Daniels Plating Barrel and Supply Company, 129 Oliver Street, Newark 5, N. J.

The framework is constructed of well-seasoned cypress and supported by channel iron legs. Its simplified design readily

lends itself to inexpensive tumbler additions or dimensional changes in cylinders. The unit is chain driven by a single constant- or variable-speed reduction motor, yet each cylinder is individually controlled with a hand-operated friction clutch.

This machine is made in multiples of two cylinder units, complete with drain pans and outlets for rapid waste removal. It can also be furnished with trays for separating work from the tumbling medium. The simplified design of this versatile tumbling barrel unit is said to make it reasonably priced and to reduce maintenance and installation costs. For further information, use Reader Service Card.

E—299. Bright Dip for Copper Alloys—The Rossani Company, 170 Fifth Avenue, New York 10, N. Y., manufacturers of Rossani Copper-Brite, nontoxic, nonfuming bright dip for brass, bronze, copper, beryllium copper, phosphor bronze, and nickel silver, announce an improved formulation that is said to lower drag-out by 50 per cent and produce a brighter passive surface on these metals. The dip, which is claimed not to discolor silver solder, is being used in the jewelry, lamp, aircraft parts, electronic, meter, motor, lock and other metal finishing industries. For further information, use Reader Service Card.

E—300. Dust Collector—Dust from swing-frame grinding operations can often be controlled, without the necessity of either a big costly booth or the very large volumes of air needed for big enclosures, by means of a standard Model 1150 Dustkop dust collector, according to Aget-Detroit Company, 375 Main at Washington Streets, Ann Arbor, Mich. This self-contained unit has a paddle-wheel fan driven by 1½-hp motor and develops a suction of 1400 cfm at the inlet. The collected dusts are removed from the air stream in two stages; first, a cyclone separator takes out the larger dusts, then a spun glass filter takes out the finer dusts before the cleaned air returns to the working space. Considerable heat is saved by recirculating the air rather than exhausting it to the outside. For further information, use Reader Service Card.

E—301. Electric Hoists—The advanced design of "Speedway" Electric Hoists manufactured by Wright Hoist Division, American Chain and Cable Company, Inc., York, Pa., incorporates all-steel construction and gear train, plus "Tru-lay Preformed" cable and swaged-on cable fittings. Other construction features are fully enclosed NEMA ball-bearing motors, splined connections, grooved steel cable drums, jaw-type brake, rabbeted male and female frame connections, push-button controls, Hyatt roller bearings, safety-limit stop, etc.

They can be furnished in lug, hook, plain, or geared Timken trolley, mounted crosswise or parallel to the runway beam, 4-part single reeve, and with motor driven trolley, and are built for 220–440 volt, 3-phase a.c. They may also be had for other voltages and frequencies in 3-phase or 2-phase applications. Capacities range from 1000 to 20,000 lb. For further information, use Reader Service Card.

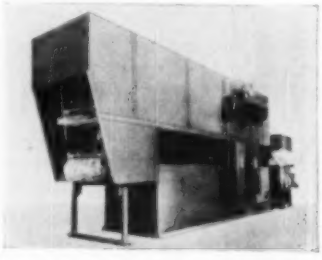
E—302. Wedge-Layer Walrus-Hide Polishing Wheel—Walrus-hide polishing wheels of wedge-layer laminated construction are now available for scratch-free finishing of copper, nickel, nickel-silver, and stainless steels, according to Greene, Tweed & Company, North Wales, Pa. Laminated polishing wheels are normally built up out of flat disks, cemented together. When the wheel revolves, the joint area strikes the work being polished at one point, with the hardened cement having a tendency to scratch, gouge, or groove. The new design causes the joint areas to weave from side to side. This enables the leather to pick up and wipe off any area traversed by the joint, removing any cement scratch, and smoothing the surface uniformly. In addition, the cement used is very strong but soft, which further lessens the chance of abrasive injury. Wheels are available in every size and due to the built-up construction, the thicker ones are low in cost. For further information, use Reader Service Card.

E—303. Perspiration-Resistant Finish—Development of a clear, fast-baking finish for metal with unusually high perspiration resistance has been announced by the Industrial Finishes Department of the Atlas Powder Company, Stamford, Conn., and North Chicago, Ill. Known as Perspiration-Resistant Clear Duranite 115–49, this new Zapon finish is already said to be used by several leading brass fabricators making lipstick cases, compacts and fountain-pen caps. Applied to brass, the coating has passed a laboratory perspiration test of 149 hours and remains unaffected after 500 hours in salt spray test and 1300 hours in humidity test. High hardness, no effect after 300 hours in the weatherometer, and unusual paleness are other characteristics claimed.

The new clear finish can be applied either by dip or spray. The baking cycle is five minutes at 350° F, or equivalent. For further information, use Reader Service Card.

E—304. Impregnated Salt Tablets—The Naval Research Institute at the National Naval Air Center, Bethesda, Md., is said to have developed the slow-dissolving salt tablet which releases some salt immediately after taking, but not enough to cause stomach distress or nausea. They are now being sold as "Pep-Up" Impregnated Salt Tablets by the United States Safety Service Company, Kansas City, Mo.

E—305. Tumbling Conveyor—The fully automatic machine manufactured by Phillips Manufacturing Company, 3475 Touhy Avenue, Chicago 45, Ill., is built for loading and unloading at the same end and can carry either flat trays or tumbling baskets alternately. The tumbling baskets are for small parts that would cup solvent. The machine comes equipped with an automatic 60–75 gph still for continuous reclamation of the solvent. All heating is electrical by immersion-type



heating elements. Both still and machine are fully automatic, having low-limit controls which shut off the heat and manual reset safety controls in the boiling chambers to shut off heaters if boiling temperature of solvent rises to the danger point due to excessive contamination or low-solvent level.

With its 2-feet load centers this machine has a capacity of approximately 2,000 to 4,000 pounds of small parts per hour, depending upon the type of part.

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Trade Literature

L—226. Fluxes for Hot Dip Galvanizing and Tinning—The Hanson-Van Winkle-Munning Company, Matawan, N. J., has issued a new Bulletin, F-100, entitled "Why and How To Use H-VW-M Fluxes for Hot Dip Galvanizing and Hot Tinning", actually a technical Instruction Manual. It gives the technical details for the use of H-VW-M No. 20 Fluxes for hot dip galvanizing and the H-VW-M Fus-Tin Flux for hot tinning. It reviews the techniques involved, describing and illustrating the pre-galvanizing cycle, giving a work flow sheet for hot galvanizing from the first alkali cleaner through pickling, rinses, fluxing and galvanizing. In hot tinning, the Bulletin describes the pre-tinning cycle and the use of Fus-Tin fluxes as a wash or a flux blanket. For your copy, use the Reader Service Card.

L—227. Maintenance Paint—Millwite, produced by the Stonhard Company, 500 Stonhard Building, (P) 1306 Spring Garden Street, Philadelphia 23, Pa., is described in a recently issued folder. A heavy, extremely white or tinted semi-paste maintenance paint, it can be applied either by brush or spray to any surface—wood, concrete, plaster, wallpaper, brick or any other interior wall surface. It is said to be resistant to fumes, mildew, moisture, and dirt. For your copy, use Reader Service Card.

L—228. Price List of American Standards—New, revised Price List of American Standards comprising listings of 988 standards, indexed by subject and alphabetically, and with a separate heading for American Safety Standards, is offered by American Standards Association, Inc., 70 E. 45th Street, New York 17, N. Y. For your copy, use Reader Service Card.

L—229. Pickling and Washing Machine—A 6-page Folder 8-7619-G1, issued by B. F. Goodrich Company, 472 S. Main Street, Akron 18, Ohio, details construction, operation and advantages of a pickling and washing machine which prepares formed metal products for enameling, painting, or plating. It features fully enclosed, high-pressure spray action and is said to be able to reduce man-hour costs by 30 to 75 per cent, cut pickling time two-thirds, and eliminate odors, corrosive fumes, splashing, and dripping. Cutaway illustrations, descriptions of important parts, and a table listing solutions used are included. For your copy, use Reader Service Card.

L—230. Industrial Waste-Disposal Bulletin—The Bristol Company, Waterbury 91, Conn., announces the publication of Industry Data Bulletin 138 entitled "Industrial Waste Disposal". The bulletin describes the application of the company's automatic *p*H-recording and -controlling instruments and recording flowmeters to industrial waste disposal operations. Photographs of the instruments and diagrams of several typical waste-disposal applications are included. For your copy, use Reader Service Card.

L—231. Steam Traps—V. D. Anderson Company, 1935 W. 96th Street, Cleveland 2, Ohio, offers a new 38-page data book and catalog entitled "Solving Steam Trap Problems" which describes new and improved steam traps. The new unit is catalogued as No. 118 and was developed as a result of a need for a smaller trap at lower first cost for small-drainage, light-condensate load jobs. It is particularly suitable for use with unit heaters and pipe coils and may be installed either as an elbow or straight-in-line without extra fittings as only one pipe nipple is required. A blow-down plug and test plug permits easy cleaning and testing. This unit is satisfactory for pressures up to 150 pounds, has a capacity rating of 700 pounds per hour (continuous flow) at 20 pounds pressure, and is made in ½-inch pipe-connection size. Nos. 110, 119 and 120 have mechanical improvements which increase the capacity of these models. They now have following capacity ratings of pounds per hour (continuous flow) at 20 psi pressure: No. 110—300 pounds; No. 119—980 pounds; No. 120—1650 pounds. These new models supplant and are designed to fit previous models Nos. 10, 19 and 20. For your copy, use Reader Service Card.

L—232. Heating Liquids with Electric Heaters—This is the title of a 12-page illustrated bulletin issued by General Electric Company, Schenectady, N. Y., which describes a variety of immersion heaters, lists their applications, shows methods of installation and operation, and provides charts and formulas for calculating heating requirements. For your copy, use Reader Service Card.

L—233. Selenium Rectifiers—Rapid Electric Company, 2847 Middletown Road, Bronx 61, N. Y., offers a 12-page illustrated catalogue, "Selenium Rectifiers for Electrochemical and Industrial Applications" which describes its full line of units, including units supplied with periodic-reversing features. For your copy, use Reader Service Card.

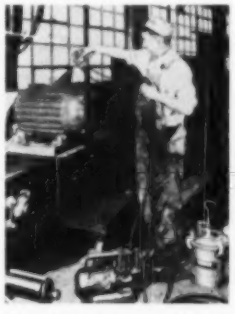
L—234. Corrosion-resisting Alloys—The Duriron Company, Dayton 1, Ohio, has published a 12-page Bulletin 113, "Duriron and Durichlor", which presents data collected during the last 15 years of use. It contains information about chemical composition, mechanical and physical properties, applications, and corrosion resistance to a large variety of chemicals of these high-silicon iron alloys. For your copy, use Reader Service Card.

L—235. Fume Washer—Maurice A. Knight Company, Kelly Avenue, Akron 6, Ohio, offers a 4-page bulletin which describes and illustrates principles of construction and operation of a number of units for different purposes. Tables relating overall dimensions and capacities are included. For your copy, use Reader Service Card.

L—236. Anode Hook—The Uzall anode hook announced in the last issue of PLATING is described in an 8-page illustrated folder offered by The Udylite Corporation, Detroit 11, Mich. For your copy, use Reader Service Card.

L—237. Portable Paint Spray Unit—The problems of regular maintenance painting are now said to have been solved by the new, light-weight, portable DP paint spray unit developed by Binks Manufacturing Company, 3122 Carroll Avenue, Chicago 12, Ill. No larger than a small tool box and weighing only 47 pounds, it will handle enamels, lacquers, house and barn paint, shellacs, varnishes, and other coatings with professional results.

The DP (meaning Direct-drive Piston) unit delivers 40 pounds working pressure



in ample volume to operate Binks standard spray guns. It plugs into any 110–120 volt a-c line. There are no exposed moving parts, the motor has a safety cut-out overload switch, and oversize cooling fins on the compressor make for continuously cool operation. For your copy of Bulletin 600 describing this unit, use Reader Service Card.

L—238. Surfacers and Grinders—A 6-page bulletin offered by Buehler, Ltd., 165 W. Wacker Drive, Chicago 1, Ill., covers two models of wet power grinders, diamond dressers for wet power grinder, belt surfacer, bench grinder and duo-belt wet surfacer, together with accessories. Also cataloged is a complete line of equipment for the metallurgical laboratory. For your copy, use Reader Service Card.

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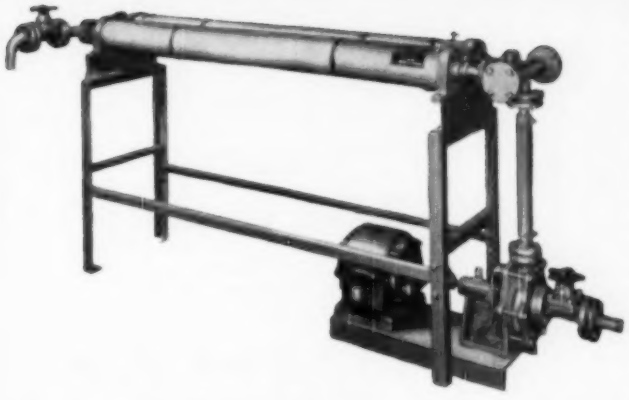

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INDUSTRIAL'S Unit Heat Exchangers are available complete with pump and stand, or tubes alone can be had for wall or ceiling mounting. A wide choice of capacity, too, is possible by using from one to six tubes in a unit. Special units are readily engineered to meet unusual capacity or space requirements.

This design of unit heat exchanger employs an inner tube of pure nickel for the solution giving an excellent heat transfer rate. Sudden temperature changes have no ill effects. Ease of inspection and cleaning is assured by a simple header construction. Rubber lined headers and diaphragm valves are used throughout.

These INDUSTRIAL Unit Heat Exchangers have been thoroughly field tested and proved for dull, semi-brite, and brite nickel plating solutions.

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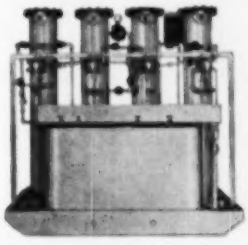

Model L-200 Four-Bed Industrial Water Demineralizer for a nominal flow rate of 200 gph. Other standard models available with capacities of 5 to 1000 gph. Special units of any capacity engineered to requirements.

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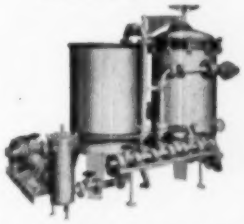

A typical Industrial Stationary Filter System. Standard models—portable and stationary types—are available in capacities of 100 to 15,000 gph. Special filters are engineered to meet unusual requirements.

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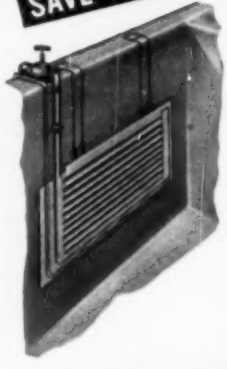

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- Higher BTU Capacity Per Square Foot of Area
- Smaller Coil Space—Greater Tank Capacity
- All Welded Seams and Joints
- No Pipe Threads in Solution
- Lower Maintenance and Initial Costs

THE **Udylite** CORPORATION
DETROIT 11, MICHIGAN

A. S. T. M.-A. E. S. SPECIFICATIONS FOR PLATED COATINGS

All numerical requirements refer to minima on significant surfaces.

Zinc on Steel: A164

Coating	Type G.S.	Type L.S.	Type R.S.
Zinc, inch	0.001	0.0005	0.00015

Cadmium on Steel: A165

Coating	Type N.S.	Type O.S.	Type T.S.
Cadmium, inch	0.0005	0.0003	0.00015

Nickel-Chromium on Steels: A166

Coating	Type D.S.	Type F.S.	Type K.S.	Type Q.S.
Copper plus nickel, inch	0.0020*	0.00125	0.00075	0.0004
Final nickel, inch	0.0010	0.0006	0.0004	0.0002
Chromium (if required), inch	0.00001	0.00001	0.00001	0.00001
Resistance to standard salt spray, hours without appreciable corrosion	96	72	48	16

*When copper is used in excess of a thickness of 0.0001 inch, its minimum thickness shall be 0.00075 inch.

Nickel-Chromium on Copper and Copper-Base Alloys: B141

Coating	Type F.C.	Type K.C.	Type Q.C.
Nickel, inch	0.0005	0.0003	0.0001
Chromium (if required), inch	0.00001*	0.00001	0.00001

*Maximum thickness should be kept below 0.00005 inch to prevent cracking.

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Nickel-Chromium on Zinc and Zinc-Base Alloys: B142

Coating	Type F.Z.	Type K.Z.	Type Q.Z.
Copper plus nickel, inch	0.00125	0.00075	0.0005*
Copper, inch	0.0004	0.0003	0.0002
Final nickel, inch	0.0005	0.0003	0.0003
Chromium (if required), inch	0.00001	0.00001	0.00001
Resistance to standard salt spray, hours without appreciable corrosion	48	32	16

*Total of 0.0003 inch if alternative of nickel only is used.

Lead Coatings on Steel: B200

Type	Copper inch	Lead inch	Salt spray Resistance* hours
E.S.	.....	0.0010	96
E.E.S.	0.000015	0.0010	96
M.S.	.....	0.0005	48
M.M.S.	0.000015	0.0005	48
P.S.	.....	0.00025	24
P.P.S.	0.000015	0.00025	24

*To standard salt spray test in hours without appreciable corrosion.

Chromate Finishes on Zinc: B201

With two crossing, 1 inch long scratches through the chromate coating only, the part shall show no white corrosion visible to the unaided eye at normal reading distance after 24 hours in a standard salt spray test.

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1949-1950 BRANCH SPEAKERS LIST

ONCE again the A. E. S. First Vice-President, who also serves as Educational Chairman, has prepared a Speakers List for use in planning your Branch program for the coming season. We have had a wonderful response from industry, and you will find that this list will give you a good cross-section of topics and talent in the finishing field.

Most of the companies approached for speakers indicated they would like plenty of notice from the Branches so as to prepare the itinerary better. Inasmuch as this list is in the hands of the Branches reasonably early, we assured them that the Branches would cooperate and arrange their season's activities in advance.

A word of caution and advice is in line at this time. Too frequently no plans are made by the Branches to meet their speaker and he is left to shift for himself. It is only fair, particularly after some prominent individual sacrifices a lot of time and effort to come before your Branch, that a local committee meet him and even plan some plant visitation for him. After this, he should always be dined with at least the local officers, and with the Branch wherever dinner meetings are held.

Frequently, educational activities are sidetracked for lengthy business sessions. It has been found by our most successful Branches that it is more desirable to hold the business sessions on another night. Many of our Branches alternate these extra meetings at the officers' homes, which also makes for good fellowship.

A suggested plan for an educational meeting is as follows:

1. Dinner at 7:00 P. M.—at least officers and speaker
2. Movies at 8:00 P. M.—industrial short
3. Latest Developments or Book Review at 8:25 P. M.

3a. Miscellaneous announcements, introduction of new members, etc.

4. Main Speaker at 8:45 P. M.
5. Questions on Speaker's Topic at 10:00 P. M.
6. General Question Box—any finishing subject
7. Refreshments

Another plan calls for a short talk by a Branch member, in conjunction with the regular speaker, each month. This gives you an opportunity to look over speaker material within the Branch and provides another possible source for papers.

This office is grateful for the wonderful response and cooperation it has received in conjunction with this project and wishes to take this opportunity to offer its profound thanks.

ARTHUR W. LOGOZZO,
Educational Chairman

ALLIED RESEARCH PRODUCTS, INC. (c)†
4004 E. Monument St., Baltimore 5, Md.—Middle Atlantic and Midwest
Contact H. C. Irvin, Manager

Subject:
Iridite

ALUMINUM CO. OF AMERICA (c)
New Kensington, Pa.—East and Midwest
Contact R. Vanden Berg, Alcoa Process Development Labs.

Subject:
Finishes for Aluminum Alloys

AMERICAN CYANAMID CO. (c)
30 Rockefeller Plaza, New York 20, N. Y.
R. L. De Horr

Subject:
Current Developments in the Use of Ion Exchange Products in the Plating Industry

AMERICAN ELECTROPLATERS' SOCIETY
Research Committee
For speakers and subjects, contact W. M. Tucker, Chairman, Research Directing Committee, c/o Eastman Kodak Company, Rochester 4, N. Y.

APOTHECARIES HALL CO. (c)
Waterbury 88, Conn.—New York State and New England
Ted Voyos, Chief Chemist

Subject:
Anodes in Plating (or other selected subjects)

BEHR-MANNING CORP. (c)
Troy, N. Y.—Any Branch
Contact H. J. Stoford, Manager, Sales Promotion Division
Subject:
Coated Abrasives and Their Applications

BETHLEHEM STEEL CO. (c)
Bethlehem, Pa.
Contact S. H. Yorks, Publications Department
Selected subjects

THE CHEMICAL CORP. (c)
54 Waltham Ave., Springfield 5, Mass.—East of the Mississippi River
K. P. Bellinger

Subjects:
1. *Alkaline, Emulsion or Acid Cleaning*
2. *Cleaning, Pickling or Drying of Metal Parts in Washing Equipment*
3. *Preparation of Metal for Zinc Plating and Subsequent Treatment by the Luster-On Process*

DARCO CORPORATION (c)
60 E. 42nd St., New York 17, N. Y.—Any Branch in U. S. and Canada East of the Rockies
W. A. Helbig, Chemical Engineer, Sales Department

Subject:
Purification of Electroplating Solutions by Filtration and Activated Carbon Treatment

THE DURIRON COMPANY, INC. (c)
Dayton 1, Ohio—Any Branch
Walter A. Luce, Metallurgical and Chemical Engineer

Subject:
Alloys for Handling Corrosive Plating Solutions

ENTHONE, INC. (c)
442 Elm St., New Haven 2, Conn.—East of the Mississippi
Dr. Walter R. Meyer, President and Technical Director, Subjects 1, 2, and 3
Clarence C. Helmle, Secretary and Chief Engineer, Subject 4
Hubert M. Goldman, Chemical Engineer, Subjects 4 and 5
A. H. Sanders, Chemical Engineer, Subject 6—Buffalo and points east

Subjects:
1. *Electroplating upon Aluminum*
2. *Bright Dipping of Metals*
3. *Preparation of Metals for Electroplating*
4. *Plating Room Layout and Electroplating Equipment*
5. *Tumble Finishing of Metals*
6. *Improving Plating Room Layout, Equipment and Management*

THE FANFILM COMPANY (c)
1220 W. 6th St., Cleveland 13, Ohio—East and Midwest
R. W. Cook, President

Subject:
Fan-Film Method of Comparing Surface Roughness

FORMAN MFG. CORP. (c)
3171 Bellevue Ave., Detroit 7, Mich.—All Branches
H. J. McAleer, President
E. W. McAleer, Vice-President
Subject:
The Inside Story About Buffing Compounds and Buffing Wheels

GENERAL ELECTRIC CO. (c)
Electronics Park, Syracuse, N. Y.—East and Midwest
G. W. Cavanaugh, Head of Chemical Section, Electronics Laboratory
Subjects:
1. *Electroplating: Its Relation to Galvanic Corrosion*
2. *Corrosion*
3. *Corrosion of Stainless Steels*

920 Western Ave., West Lynn 3, Mass.—Any Branch
Contact I. A. Lee, Sales Manager, Rectifier Sales Division

Subject:
Rectifiers

GENERAL MOTORS CORP. (c)
Research Laboratories Division, P. O. Box 188, North End Station, Detroit 2, Mich.—Any Branch
C. F. Nixon, Ternstedt Division
G. M. Cole Ternstedt Division
F. L. Clifton, Research Laboratories Division
W. M. Phillips, Research Laboratories Division
Subject to be selected

GRAHAM, CROWLEY & ASSOCIATES, INC. (c) ½ and (b)* ½
473 York Rd., Jenkintown, Pa.—East of Mississippi River
Dr. A. Kenneth Graham, Consultant

Subjects:
1. *Observations in the Plating of Powdered Metal Compacts*
2. *Modern Brass Plating*

W. GREEN ELECTRIC CO., Inc. (c)
130 Cedar St., New York 6, N. Y.—East of the Mississippi
L. W. Reinken, Chief Engineer
Subject:
About Rectifiers (Questions and Answers)

FREDERICK GUMM CHEMICAL COMPANY, INC. (c)
538–542 Forest St., Kearny, N. J.—New England and Middle Atlantic
A. S. Kohler, Chief Chemist

Subjects:
1. *Barrel Deburring*
2. *Barrel Burnishing*
3. *Cleaning of Wrought Aluminum*

HANSON-VAN WINKLE-MUNNING COMPANY (c)
Matawan, N. J.—East and Midwest
Myron B. Diggin, Subject 1
Paul J. Lalonde, Subject 1 East, Subject 5 East and Midwest
Allen T. Baldwin, Subject 2
Martyn J. Moll, Subject 3
D. Gardner Foulke, Subjects 1 and 4
2920 Carroll Ave., Chicago 12, Ill.—Midwest
Raymond F. Ledford, Subject 1

2842 W. Grand Blvd., Curtis Building, Detroit 2, Mich.—Midwest
Bernard C. Case, Subject 1

West Coast Branches by special arrangement

Subjects:
1. *Plating and Electrochemical*
2. *Hot Galvanizing and Hot Tinning*
3. *Automatic Electroplating Equipment*
4. *Pfl Process and Magnesium Anodizing*
5. *Electrotyping and Stereotyping*

THE HARSHAW CHEMICAL CO. (c)
1945 E. 97th St., Cleveland 6, Ohio—Middle Atlantic and Midwest
Dr. M. M. Beckwith, Manager, Technical Sales—Electroplating
A. H. De Rose, Technical Service—Electroplating
Subject to be selected

* Expenses paid by Branch † Expenses paid by Company

HOUDAILLE-HERSHEY CORP. (b)
9120 Roselawn Ave., Detroit 4, Mich.—East and Midwest
Walter L. Pinner, Manager of Research
Chicago Bumper Division, 1455 W. 38th St., Chicago 9, Ill.—Midwest
L. C. Borchert
Subjects:
Copper, Nickel and Chromium Plating with special consideration to plate distribution, testing of deposits, anode studies, etc.

R. O. HULL & COMPANY, INC. (c)
1279 W. 3rd St., Cleveland 13, Ohio—East and Midwest
R. O. Hull, President
J. B. Winters, Research Chemist
E. B. Wild, Technical Representative
Selected subjects

INDUSTRIAL FILTER & PUMP COMPANY (c)
1621-1639 W. Carroll Ave., Chicago 12, Ill.—East and Midwest
Harold W. Faint, Sales Manager
Subjects:
1. *Filtration of Plating Solutions*
2. *Water in the Plating Room*

INTERCHEMICAL CORP. (c)
Finishes Division, 57 State St., Newark 1, N. J.—Middle Atlantic, Midwest and West Coast
Contact E. D. Horgan, Manager, Sales Promotion
Subject:
Organic Finishing

THE INTERNATIONAL NICKEL COMPANY, INC. (c)
67 Wall St., New York 5, N. Y.—East, Midwest and Far West
Walter H. Prine, Subject 1
C. H. Sample, Subjects 2 and 3
Subjects:
1. *Industrial Nickel Plating*
2. *Specifications and Tests for Electrodeposited Coatings*
3. *Corrosion Behavior and Protective Value of Electrodeposited Coatings*

LASALCO, INC. (c)
2820-2830 La Salle St., St. Louis 4, Mo.
B. G. Daw, President—East, Middle Atlantic, Midwest and West; (b) Far West
H. J. Struckhoff, Vice-President—East, Middle Atlantic, Midwest
A. J. Bignall, Sales Engineer—East, Middle Atlantic, Midwest
Subject:
Mechanical Plating and Tumbling

THE LEA MFG. CO. (c)
16 Cherry Ave., Waterbury 86, Conn.
Richard P. Crane, Vice-President—East, Middle Atlantic and Midwest, Subject 1
Dr. Henry L. Kellner, Technical Director—East and Middle Atlantic, Subject 2
Ellsworth T. Candee, Director of Research—East, Subject 3
Wesley L. Cassell, Field Engineer—New England and New York State, Subject 4
William D. Stark, Purchasing Agent—New England and Metropolitan New York, Subject 5
Subjects:
1. *Surface Finishing*
2. *Polishing and Buffing*
3. *Metal Finishing Research*
4. *Plating Room Engineering*
5. *Purchasing Plating Supplies*

MAC DERMID, INCORPORATED (c)
Waterbury 88, Conn.
Henry Strow—Midwest and New England, Subject 1
A. J. Dankevich—New England, Subject 2
G. S. Krentel—California, Subject 3
Stanley S. Krentel—Midwest, Subject 3
William D. Gordon—Midwest, Subject 4
Subjects:
1. *Bright Copper and Bright Nickel Plating*
2. *Treatment of Bright Nickel Solutions*
3. *Bright Copper Plating*
4. *Removal of Impurities in Bright Nickel and Bright Copper Plating Solutions*

W. D. MAC DERMID CHEMICAL COMPANY (c)
Bristol, Conn.—East
E. J. Belgin
Contact for subject

DR. F. C. MATHERS (b)
Department of Chemistry, Indiana University, Bloomington, Ind.—East and Midwest
Subjects:
1. *Effect of Small Quantities of Material in Chemical Production*
2. *Accidental Discoveries*
3. *Stripping of Copper from Base Metals*
4. *The Rarer Elements*
5. *Effect of Addition Agents in the Electrodeposition of Various Metals*

MINE SAFETY APPLIANCES CO. (c)
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310 Copley Square Building, 30 Huntington Ave., Boston 16, Mass.
J. J. Dever, Manager
1718 Main St., Buffalo 8, N. Y.
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4349 Armitage Ave., Chicago 30, Ill.
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82 Fulton St., New York, N. Y.
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1105 N. Water St., Milwaukee 2, Wisc.
F. G. Grabau, Manager
30 Fulton St., Newark 2, N. J.
E. M. McCoot, Manager
5564 Baltimore Ave., Philadelphia 43, Pa
E. C. Brainerd, Manager
918 F St., N. W., Washington 4, D. C.
W. T. Cofer, Jr., Manager
556 N. Skinker Blvd., St. Louis 5, Mo.
R. V. Fitzpatrick, Manager
Subjects:
1. *Health and Safety Hazards in Plating Operations* (including demonstration of personal protective equipment)
2. *The Air We Breathe* (26-minute, 16-mm sound movie with a short talk)

MINNEAPOLIS-HONEYWELL REGULATOR COMPANY (c)
Brown Instruments Division, Wayne and Roberts Aves., Philadelphia 44, Pa.—Any Branch
Contact W. T. Rockhill, Sales Department
Subject:
Temperature Control in Plating Operations

MITCHELL-BRADFORD CHEMICAL COMPANY (c)
Bridgeport, Conn.—East and Midwest
Robert T. Sammet, Director of Research
Subject:
Chemical Metal Finishing

MILTON NADEL (b)
41-15 Fiftieth Ave., Long Island City 4, N. Y.
Supervisor of Metal Finishing, Consolidated Razor Blade Corp., Jersey City, N. J.
Subjects:
1. *Surface Finishing of Aluminum and Its Alloys*
2. *Practical Aspects of Plating on Zinc Base Die Castings*

NATIONAL BUREAU OF STANDARDS (b) and partial (c) under special conditions
Washington 25, D. C.—Any Branch
Dr. Abner Brenner, Subjects 1 and 2
Seymour Senderoff, Subject 3
Dr. William Blum, Subject 4
Subjects:
1. *Deposition of Nickel and Cobalt Containing Phosphorus*
2. *The Physical Properties of Electrodeposited Metals*
3. *The Measurement of Stress in Electrodeposited Coatings*
4. *General talks on electrodeposition*

NATIONAL TECHNICAL LABORATORIES (c)
South Pasadena, Calif.
Dr. A. O. Beckman, President—Any Branch through special arrangement
T. F. Hepbing, Sales Manager—Any Branch through special arrangement
1114 First Ave., New York 21, N. Y.
E. C. Bowen—New England and New York
8505 Hazelwood Dr., Bethesda, Md.
Dr. E. D. Haller—Southwest
9 S. Clinton St., Chicago 6, Ill.
G. R. Kincaid—Midwest
820 Mission, South Pasadena, Calif.
W. W. Beatock—West and Pacific Coast
Contact for subject

NORTON COMPANY (c)
Worcester 6, Mass.—Any Branch
Contact Technical Service Section
Subjects:
1. *Polishing with Abrasives* (and related subjects)
2. *Polishing with Coated Abrasives*

NUTMEG CHROME CORP.
79 Chapel St., Hartford 3, Conn.—New England (c), Middle Atlantic and Midwest (partial b)
A. W. Loggozzo, President
Subjects:
1. *Bright Nickel and Decorative Chrome*
2. *Hard Chrome Problems*

OAKITE PRODUCTS, INC. (c)
22 Thames St., New York 6, N. Y.
Contact Dr. Donald Price, Technical Director
Selected subjects

ONEIDA, LTD. (c)
Oneida, N. Y.
Daniel Gray, Chief Chemist, Subject 1
Frank Mesle, Subject 2
Subjects:
1. *Some Special Problems of Plating*
2. *The Problems and Progress of Silver Plating*

THE OSBORN MFG. COMPANY (c)
5401 Hamilton Ave., Cleveland 14, Ohio—East and Midwest; South and far West by special arrangement
F. T. Turner, Assistant Sales Manager
C. W. Newman, Sales Engineer
A. J. Chandler, Sales Engineer
Subject:
Brush Finishing

PARKER RUST PROOF CO. (c)
2177 E. Milwaukee Ave., Detroit 11, Mich.
H. L. Greene, Central Region Manager
H. C. Gibson, Technical Director
W. B. Rouss, Assistant General Sales Manager
F. J. De Witt, General Sales Manager
60 E. 42nd St., New York 17, N. Y.
S. J. Colvin, Eastern Region Manager
135 S. La Salle St., Chicago 3, Ill.
E. B. Thompson, Western Region Manager
501 Financial Center Building, Oakland 12, Calif.
S. N. Headley, Pacific Coast Region Manager
Subjects:
1. *Metal Treatments Prior to Painting*
2. *Corrosion Preventive Phosphate Coatings*
3. *Phosphate Coating of Bearing Surfaces to Reduce Wear*
4. *Phosphate Coating of Metals to Facilitate Drawing*
5. *Phosphate Coating of Aluminum to Increase Paint Adhesion*
6. *Some Economic Considerations of Bonderizing*

POOR & COMPANY (c)
Promat Division, 851 S. Market St., Waukegan, Ill.—East of the Mississippi River
A. E. Chester, Director of Research
Bruno Leonelli
C. L. Ricketts
J. E. Bach
Subject:
Current Trends and Practices in the Deposition of Zinc

ROTO-FINISH CO. (c)
3600 Milham Rd., Kalamazoo, Mich.—Midwest
C. H. Castle, Technical Director
Subject:
Mechanical Finishing by the Roto-Finish Processes

FOSTER D. SNELL, INC. (c)
29 W. 15th St., New York 11, N. Y.—East and Middle Atlantic
Dr. Foster Dee Snell, President
Subject:
Detergency and Surface Activity (with lantern slides)

SPARKLER MFG. COMPANY (c)
Mundelein, Ill.
A. C. Kracklauer—Any Branch
K. L. Carr—Any Branch
R. H. Helgeson—New England
G. C. Garland—Metropolitan New York
J. C. Sharbaugh—Eastern Pennsylvania, Southern New Jersey, Delaware, and Maryland
J. L. Kelly—Western Pennsylvania, Northern New York, and West Virginia
H. L. Dick, Michigan, Ohio, and Northern Indiana
Subject:
Plating Solution Filtration

STANDARD STEEL SPRING CO. (c)
Coraopolis, Pa.—Midwest, North Atlantic and East
G. B. Bowman, Chief Chemist
Subject:
The Coronizing Process (with lantern slides)

SULPHUR PRODUCTS CO., INC. (c)
Greensburg, Pa.—Any Branch
Wilfred S. McKeon, President
Subject:
Stripping Copper—Non-Dangerously

TECHNIC, INC. (c)
39 Snow St., Providence 3, R. I.—East
Frank K. Smith, President
Dr. Edward A. Parker, Technical Director
Subject:
Gold Plating

THE UDYLITE CORP. (c)
Detroit 11, Mich.—East and Midwest
William Jackson, Engineer, Subject 1
John Davis, Chief Engineer, Subject 2
Gust Kentta, Engineer, Subject 3
Dr. R. B. Saltonstall, Technical Director, Subject 4
Subjects:
1. *Barrel Plating*
2. *Automatic Plating Equipment*
3. *Plating Room Layout*
4. General electroplating topics

UNITED-CARR FASTENER CORPORATION (b)
Cambridge 42, Mass.—New England
Leonard A. Chesworth, Chief Chemist
Subject:
Barrel Finishing

UNITED CHROMIUM, INC. (c)
51 E. 42nd St., New York 17, N. Y.—East
H. Mahlstedt, Subjects 1, 2, 3, 4 and 5
R. K. Guffie, Subjects 2, 3, 4 and 5
F. Fulforth, Subjects 4 and 5
E. N. Riotte, Subjects 4 and 5
Waterbury 90, Conn.—East
Dr. G. Dubpernell, Subjects 1 and 7
M. Shacat, Subjects 1, 2, 3, 4, and 5
W. Gaunt, Subject 5
Carteret, N. J.—East
D. E. Hartman, Subject 6—East and Midwest
D. Meserve, Subject 6
F. L. Scott, Subject 6
2751 E. Jefferson Ave., Detroit 7, Mich.—Midwest
W. S. Cibulskis, Subjects 1 and 2
R. H. Dudley, Subjects 1, 2, 4 and 5
C. H. Eldridge, Subjects 2, 4 and 5
J. J. Hanney, Subjects 2 and 5
L. M. Weiss, Subject 2
Dr. J. E. Stareck, Subjects 3 and 4
A. M. Linn, Subject 3
C. G. Miller, Subject 4
208 S. La Salle St., Chicago 4, Ill.—Midwest
E. M. Relitz, Subjects 1, 4 and 5
C. W. Carter, Subjects 1, 2, 4, 5 and 6
505 Commercial Building, Dayton 2, Ohio—Midwest
L. A. Critchfield, Subjects 2, 4, 5 and 6

E. W. Reimel, Subjects 2 and 6

923 E. Third St., Los Angeles 13, Calif.—West Coast

R. J. Woolley, Subjects 1, 2, 4, 5 and 6

United Chromium Limited, 15 Emily St., Toronto, Canada—Canada

James Guffie, Subjects 1, 2, 4, 5 and 6

Subjects:

1. *Chromium Plating*
2. *Copper Plating from Pyrophosphate Baths*
3. *Electrocolor and Patternplate*
4. *Anodizing and Dip Conversion Coatings for Zinc*
5. *Rack Coatings and Plating Stop-Offs*
6. *Organic Finishes and Protective Coatings*
7. *Plating Literature*

THE UNITED STATES STONEWARE COMPANY (c)

60 E. 42nd St., New York 17, N. Y.

S. A. Lewis, Process Equipment Division

Subject:

Corrosion Resistant Materials Available to the Electroplater

WEIRTON STEEL COMPANY (c)

Weirton, W. Va.—East and Midwest

S. S. Johnston, Technical Director, Tin Mill Electrolytic Department

Subjects:

1. *High-Speed Tin Plating of Wide Strip Steel*
2. *Continuous Zinc Plating of Wide Strip Steel*

(Movie "Tinplate" is available)

WESTERN ELECTRIC CO. (c)

Hawthorne Station, Chicago 23, Ill.—East and Midwest

A. G. Russell, Dept. 6724, Subject 1

F. J. Kolar, Jr., Dept. 6634, Subject 2

Subjects:

1. *Application and Control of Nickel and Chromium Plating on Automatic Platers*
2. *Zinc Plating*

WYANDOTTE CHEMICALS CORP. (c)

Wyandotte, Mich.—East and Midwest

Dr. Roy E. Heath, Manager Industrial Department, Subject 1

Mr. Evans S. Schmeling, Assistant Manager Industrial Department, Subject 1

Dr. L. E. Kuentzel, Physics Section Head, Subject 2

Lowell McCoy, Section Head, Industrial Research Laboratory, Subject 3

Subjects:

1. *Alkalies in Metal Cleaners*
2. *Application of Physical Methods to Electroplating Problems* (electron microscope, X-ray diffraction, etc.)
3. *Barrel Finishing*

ALL EXECUTIVE BOARD MEMBERS are available for talks on A. E. S. functions as well as various plating subjects.

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INDICATE A 575

Branch News

BALTIMORE-WASHINGTON BRANCH

The regular monthly meeting on May 10 was held in Washington with an attendance of about forty. The business session included installation of the new officers for the 1949–1950 season.

Librarian Bradford Clark introduced the speaker of the evening, Mr. Harry Irwin, President of Allied Research Products, Inc., of Baltimore. The members present, who expected to hear a talk on Iridite finishing processes, were treated to a surprise when the speaker discussed instead such matters as taxation and government regulation. A movie, "Magazine Magic", was shown, which described the processes involved in the production of Crowell-Collier Publishing Company's magazines. A social period, during which free beer and cokes were served, followed adjournment.

Vernon A. Lamb, *Secretary*

BRIDGEPORT BRANCH

Forty-two members and guests heard Mr. Myron B. Dugan, Technical Director, Hanson-Van Winkle-Munning Company, discuss "Leveling of Electrodeposits" at the Open Meeting on March 18. Brush Surface Analysis had shown steel polished with 150 emery to have rms readings of 20–22 and with 220 emery readings of 8–10. Deposits 0.001 inch thick on steel with initial readings of from 16 to 22 showed no effect on smoothness when deposited from Watts, bright, or rapid chloride baths. With electropolished Watts nickel the rms reading was reduced from 21 to 8, and with a suitable cobalt-nickel from 20 to 8 (0.003 inch lowered it to 3). Rochelle copper raised the reading from 18 to 23, but cadmium reduced it from 16 to 9. The smoothed deposits tested require less buffing than the unsmoothed deposits. A lively discussion followed.

Dr. Walter R. Meyer, President, Enthone, Inc., New Haven, Conn., gave a resume of U. S. Patent 2,244,606 which deals with bright dipping of copper, brass and aluminum in a solution of equal volumes of nitric, phosphoric, glacial acetic acids in water, at 75–150° F.

Joseph G. Sterling,
Secretary-Treasurer

LANCASTER BRANCH

Thirty-eight members and guests attended the visitation of the Lititz plant of the Animal Trap Corporation of America on April 8. Here we were shown the various steps of manufacture of mouse and other small animal traps of the familiar "Victor" brand. After a delicious dinner at the Warwick House in Lititz, we

were instructed in the art of "Surface Preparation of Metals for Electroplating" by that eminent authority on the subject, Dr. Walter R. Meyer, President of Enthone, Inc. For those of us who are confronted with occasional trouble shooting, he presented a list of the fifteen most probable causes of poor adhesion. After a short discussion on the subject of aluminum plating, Dr. Meyer closed by answering any and all questions.

C. W. Smith, *Secretary-Treasurer*

LOS ANGELES BRANCH

Dr. Carl Zappfe of the Battelle Memorial Institute spoke about "Aspects of Hydrogen in Electroplating" at the meeting on April 13. A lively question and answer period followed his most interesting talk.

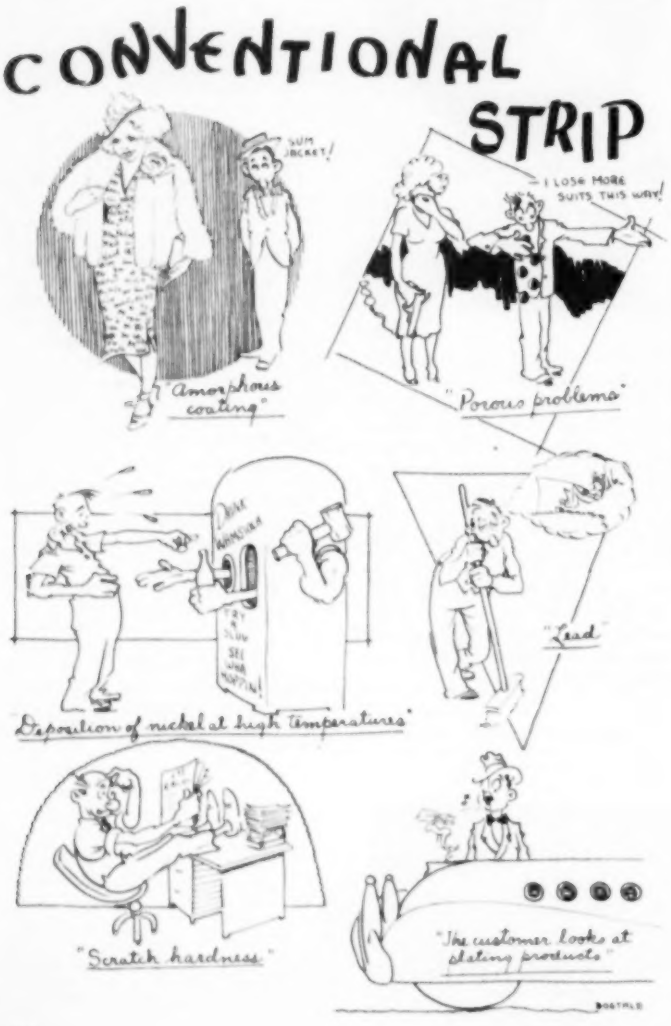
It was reported that 355 had attended the Annual Dinner at the Breakfast Club.

R. J. Woolley submitted the advertising report on the yearbook, which showed a net profit of $1,576.16. Bob Longacre and Dean Williams were given a special vote of thanks for their splendid work in preparing the yearbook. The profit will be set aside as a 1951 Convention Fund.

Articles of Incorporation of the Branch were recorded by the Los Angeles County Clerk on February 15, 1949. Directors are the Board of Managers, at present Messrs. Bedwell, Bunker and Coffin.

Installation of the new officers was conducted by Earl Coffin. A vote of thanks was given to the outgoing group for a job well done.

George M. Kent, *Secretary*



LOS ANGELES BRANCH

The regular meeting on May 11, held in the cafeteria of the L. H. Butcher Company, began with a dinner served with the compliments of the host company.

Following a short business meeting Mr. Arthur Gaskin of the L. H. Butcher Company delivered a very informative talk on "Buffing and Polishing Compounds".

Mr. Swarz suggested that the Research Committee be contacted at Milwaukee by our Delegates to promote a project on the West Coast. It was pointed out that additional sustaining memberships could be obtained from this area.

Earl Coffin presented a gift of gold lighter and pipe to retiring President Frank Bunker on behalf of the Branch as a token of appreciation for his efforts during the past year.

M. H. Orbaugh, *Secretary*

LOUISVILLE BRANCH

At the April 21 meeting, Stanley Beyer reported, with Herb Pate, for the By-Laws Committee. A copy of the proposed By-Laws is to be sent to each member to study, and the By-Laws are to be up for approval at the May meeting.

President Albert Steidle introduced Mr. Melvin Kiesler of the Egyptian Lacquer Company who explained clearly the formulation of a nitrocellulose lacquer and the properties imparted by various natural and synthetic resins.

That Mr. Kiesler's efforts were appreciated was evidenced by the numerous questions asked following his formal presentation.

S. J. Beyer, *Secretary*

MELBOURNE BRANCH

The 41st regular meeting was held in the Metallurgy Theatre of the Melbourne Technical College on March 17. After the typical preliminaries of membership business and By-Law revision, Librarian Hugh Teague introduced Mr. Jack Flavell, who gave an exceptionally clear and informative address on "Mechanical Finishing by Barrel Processing". The speaker explained how modern tumbling may be divided into four stages, grinding, honing, polishing, and coloring, and stressed the importance of correct choice of barrel speed, load, type of chip and compound. These points were illustrated by passing around the audience examples of work done by the process and by a film showing the operation of the process in U. S. A.

Shortage of time forced Chairman Leigh to close a long and vigorous discussion period.

John J. Dale, *Hon. Secretary*

MELBOURNE BRANCH

Four new members were admitted to membership at the meeting on April 21.

The meeting accepted the invitation of former President ANDREWS for the Branch to visit his plant one evening to view his new bright nickel plating outfit in operation.

The technical program consisted of the showing of a series of educational films by the State Film Centre. Subjects covered included Transformation of Energy, Heat and Light from Electricity, Magnetic and Chemical Effect of Electricity and the Evergreen Atomic Energy. The showing took more than an hour and was viewed with interest by all present.

JOHN J. DALE, *Hon. Secretary*

MILWAUKEE BRANCH

The 400th regular meeting was held on May 6, with EUGENE BOSS, presiding in the absence of President Hartshorn.

Nominations and elections of officers were held with the following results:

President—HENRY BORNITZKE
First Vice-President—EVERETT ROBINSON
Second Vice-President—VINCE MATTACOTTI
Secretary-Treasurer—HARRY KRUEGER
Librarian—FRED ANDERSON
Assistant Librarian—FRANK BUSCHNER
Board of Managers—TED HARTSHORN, elected to three-year term

LIBRARIAN LES DIVELEY then introduced MR. E. M. RELITZ, United Chromium, Incorporated, Chicago, who gave a very interesting informal talk about everyday problems in chromium plating. After a lengthy question and answer period, refreshments were then served through the courtesy of United Chromium.

One application was elected to membership.

HARRY J. KRUEGER,
Secretary-Treasurer

MONTREAL BRANCH

There was one application for membership at the meeting on April 5, attended by eighteen members and guests.

P. M. COADY introduced MR. J. T. REISENBURG, whose subject was "Principles of Buffing and Polishing". The speaker defined polishing as the removal of elevated surfaces on a piece of material to reach a common level in order to secure a smooth and pleasing effect to the eye. General methods of polishing have changed considerably. Sand buffing, which at one time was entirely with walrus hide or leather wheels with small diameters, is now done with felt wheels as large as 16 inches in diameter. Speed of wheels has also increased, from approximately 2500 to 3000–3600 rpm. At higher speeds it is essential that the buff be of good quality so that the compound will remain on the wheel. Good quality compound has better adhesion at high speeds and should be chosen to suit each specific job. The most expensive buffs are not always recommended. Glued wheels should be left 48 hours before they are put into production.

The following were elected to serve during 1949–1950:

President—J. D. FAIRBAIRN
First Vice-President—J. H. CHARLES
Second Vice-President—P. J. SLOANE
Third Vice-President—J. COURTMANCHE
Secretary—G. R. KING
Librarian—P. M. COADY
Board of Managers—G. MORRISSETTE, O. MOLDENSCHART and B. MENDELS

A committee consisting of J. T. REISENBURG, P. M. COADY and J. G. CARRIQUE was chosen to draw up a set of Branch By-Laws.

GEORGE R. KING, *Secretary*

NEWARK BRANCH

The Branch made an inspection trip through the new electroplating laboratory of Hanson-Van Winkle-Munning Company, Matawan, N. J., on the evening of April 1. Eighty-one members and friends showed up for the trip; those who did not, really missed a treat. Groups of about a dozen people were escorted by personnel members through the various rooms, and it took about two hours to see the latest equipment for electroplating on small and large scale. Specialists belonging to the laboratory described their activities and gave interesting demonstrations. The tour ended in a spacious lobby, where refreshments were served.

Our thanks go to the Hanson-Van Winkle-Munning Company for its fine hospitality and especially to MYRON DIGGIN, its Technical Director and our First Vice-President, for making the arrangements for this fine get-together.

SAMUEL S. FREY, *Recording Secretary*

STANDS UP IN ALL CYCLES!

Outstanding rack protection achieved by plastisol Unichrome COATING 218X

No matter what you need in rack protective qualities, Coating 218X has it. Resistance to vapor degreasing? Coating 218X has that! Ability to stand up in hot cyanides or caustics? In chromium plating? Again 218X is the answer. And if it can withstand *those* plating operations, it will take them *all*.

In test runs at a well known plating plant, for example, Coating 218X was put through a cycle including soak cleaners, anodic alkaline cleaner, cyanide dip, acid dips, nickel plate, chromium plate and chromium strip. There was still no attack after *840 cycles*, at which time the attempt to break down Coating 218X was abandoned!

Physically, too, Coating 218X leads. It won't chip, resists cutting and abrasion, minimizes dragout. All in all, it's easy to see why your rack coating costs will hit bottom with Coating 218X. Write today for prices.

(NOTE: Applicators nearby can bake 218X onto your racks if you have no facilities for applying it. Ask for names.)

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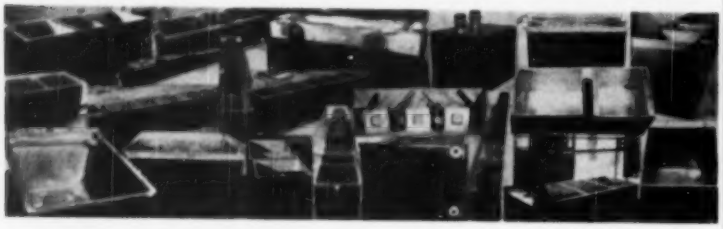
UNITED CHROMIUM, INCORPORATED • 51 E. 42nd St., New York 17, N.Y.
Detroit 7, Mich. • Waterbury 91, Conn. • Chicago 4, Ill. • Dayton 2, Ohio • Los Angeles 13, Cal.

FOR FURTHER INFORMATION, USE READER SERVICE CARD: INDICATE A 576.

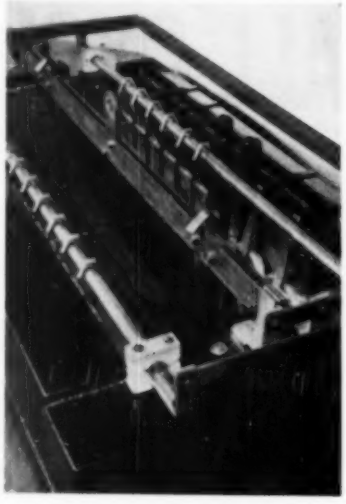


The inside story of

LOW MAINTENANCE COST

CORROSION costs more than corrosion prevention. That is the secret of eliminating maintenance and replacement costs on cleaning, rinsing and plating tanks. Keep corrosion out and your tanks keep working. Two "inside" features of the tanks in the group shown above are: (1) lead linings that defy acid attack, and (2) Stortswelding techniques on all seams, leaving no cracks or crevices to aid and abet corrosion. In the services where the inherent properties of lead are generally adapted, there is no better material to assure minimum corrosion.

More of the "inside" story is told in this close-up of a plating tank fabricated, lead lined and fitted by Storts. All the copper work is special and is designed and constructed to provide maximum work handling ease, efficiency in operation. Here Stortswelding supports good design with the vital qualities of soundness, ruggedness and long, trouble-free life.



Keep inside your maintenance budget by specifying Storts welded fabrication on your requirements for tanks and accessory items. We shall be glad to quote on your new work or replacements, single tanks or complete tank cycles.

STORTS WELDING COMPANY
INCORPORATED
42 Stone Street Meriden, Conn.

Manufacturers of Welded Fabrications to Specifications

NEW YORK BRANCH

Six new applications for membership were received and ten new members were elected at the meeting on March 11.

Election of officers for the coming year yielded the following results:

President—MILTON NADEL
First Vice-President—GEORGE HERRMANN
Second Vice-President—JOSEPH HAAS
Secretary-Treasurer—FRANKLYN MAC STOKER
Financial Secretary—MARTIN MAHER
Librarian—DERRICK HARTSHORN
Recording Secretary—ALBERT FUSCO
Sergeant-at-Arms—ANGELO AMATORE
Trustees—WILLIAM SCHNEIDER, GEORGE SCHORR, and AL BRAUN

The new Educational Committee consists of GEORGE HERRMANN, GEORGE SCHORR, DR. HERBERT BANDES, LIONEL DE WALTOFF, ED. RINKER and BEN FLUG.

MR. JOSEPH HAAS of this Branch delivered a paper about the "Engineering Aspects of Full-Automatic Plating Units". Special emphasis was placed upon their advantages, and typical plating cycles were given.

One new application for membership was received on March 25. Our speaker for the evening, MR. BEN FLUG of Flurey Products, drew a crowd of eighty-seven members. The subject of his talk was "Practical Aspects of Bright Nickel Plating". Mr. Flug discussed the difficulties usually encountered in production, their causes and cures, as well as their prevention. Some ingenious solutions were mentioned.

ALBERT FUSCO, *Recording Secretary*

PHILADELPHIA BRANCH

The April meeting was a dinner meeting at Moschoch's Restaurant on April 22 attended by sixty members and guests.

The first speaker was MR. EDWIN F. OTTENS of the Philco Corporation, who gave a short talk on the use of phosphoric acid type cleaners for aluminum to procure paint adhesion. The simplicity and economy of the process was stressed.

The principal speaker was MR. J. B. WINTERS, R. O. Hull Company, Cleveland, Ohio, who spoke on the use of the Hull Cell in plating bath control. He exhibited panels showing the effects of various impurities and varying concentrations of bath ingredients on plating characteristics. Described in detail were the effects of varying concentrations of bath ingredients, addition agents and impurities in nickel, chromium (over bright nickel), high-speed cyanide copper, cadmium, cyanide zinc, and silver plating solutions.

A question period followed in which both speakers participated.

H. L. PINKERTON conducted the Question Box, which brought forth the following:

Q. 1. How do you remove excess chloride from an acid copper bath? *A.* Add a solution of a soluble silver salt which will precipitate the chloride as silver chloride. The silver chloride may be recovered by filtration and salvaged. The use of lead or mercury salts was not recommended.

Q. 2. Other things being equal, what effects do increased temperature and increased current density have on throwing power? *A.* Both tend to reduce it.

MR. R. O. HULL, inventor of the Hull Cell, was introduced and spoke briefly of his aim in simplifying plating solution control.

The Secretary reported on the business meeting held at Mosebach's on April 11 by the Branch officers, Board of Managers, and committees. The membership report showed two active members admitted, five applications for active membership, one transfer and one resignation. Word of the passing of MR. ELMER E. SAVAGE of Reading, Pa., was received. Mr. Savage, who was 68, had been a member of the Philadelphia Branch since 1927.

The Branch Research Committee, J. ALBERT CAIRNS, Chairman, asked the members to boost the Research Committee to their employers who are being solicited for sustaining memberships.

The Membership Committee, GEORGE A. GUMM, Chairman, announced that a prize was being considered for the member who brought in the most new members as indicated by the first endorser on the application blank.

The membership of the Board of Managers was increased from three to four and PAUL MENTZER, SR., was elected to fill the post.

J. WM. MARCOVITCH,
Secretary

SAGINAW VALLEY BRANCH

Fifty-five members and guests attended the meeting at Rollie McNivens Hotel in Frankenmuth, Mich. The meeting was opened by DAN WAITS who presented a gavel to ROLLIE DURHAM, the Past President, in appreciation of the fine work he did.

MANUEL BEN made a suggestion that our Delegates for the National Convention be instructed to vote on a reduction of the per capita tax. The suggestion was passed by the members.

Four neckties, presented by J. H. RHODES of the Northwest Chemical Company as a door prize, were won by JOHN W. LEE.

MR. H. CASTLE of Roto-Finish Company, Kalamazoo, Mich., gave a talk on "Mechanical Finishing", illustrated with motion pictures. He also showed a number of colored slide films that he had taken in London, England. A technicolor sound film about manufacturing of spark plugs was also shown.

JOHN W. LEE,
Recording Secretary

ST. JOSEPH VALLEY BRANCH

"Ladies' Night" on May 4 in the Empire Room of Hotel Elkhart was enjoyed by thirty members and twenty ladies. After a dinner the ladies were shown movies while the men held their business and technical session.

The speaker of the evening, MR. FRANK L. CLIFTON, General Motors Research Laboratories Division, substituted for Mr. William Phillips, who could not attend on account of illness. Mr. Clifton gave a very interesting talk on "Useful Instruments for the Control of Electroplating".

At the close of the Question Period the new officers were installed by PRESIDENT HEDGES. The technical session was followed by a social gathering and special entertainment.

V. E. PETERSON,
Secretary-Treasurer

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Your polishing Jacks and Lathes to THE ABRASIVE BELT SYSTEM with PRODUCTION BACKSTANDS

Many polishing operations can be done faster and more economically by the use of abrasive belts with contact wheel and backstand.

This latest model backstand is heavily constructed with machine tool accuracy. Reversible for right or left hand installation . . . Remote control belt tracking device . . . Constant and adjustable belt tension . . . 12" cast aluminum idler pulley equipped with roller bearings, assures quiet vibrationless operation. Belt changing is accomplished in a matter of seconds.

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HIGH SPEED ALKALINE CLEANER

• Cowles KW is a fast, efficient and economical cleaner for cleaning steel, die castings, polished and unpolished brass, copper and bronze. It may be used in still tanks with or without electric current and also in all types of washing machine equipment. Cowles KW does not attack the metal.

Adaptable with Cowles KW Cleaner are Cowles emulsion type cleaners, SK and LIXOL. These combinations are excellent for pre-soak cleaning and ideal for preparing steel for enameling.

Immediate shipment from warehouse stocks.

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TECHNICAL SERVICE
ON REQUEST

Cowles Chemical Company

METAL CLEANER DEPARTMENT • CLEVELAND 3, OHIO

Membership Report of the A. E. S.

Elections

BALTIMORE-WASHINGTON BRANCH: Reginald A. Biser, Vincent J. Hughes, Jr., Melvin R. McChesney, William H. Metzger, Jr., John P. Young

BUFFALO BRANCH: Kay S. Blackman, Frederick E. Busemann, George A. Castle, George R. Castle, John B. Hitchcock, Edsel C. Laing

CHICAGO BRANCH: Robert L. Clark, Louis P. Krick, D. F. Lord, E. I. Peters, Eugene Schmidt, Robert E. Stewart

CLEVELAND BRANCH: Chester A. Bielawski, Max A. Bondra, Emory B. Michel, N. Knute Morelli, George R. Kingsbury, Clarence G. Ozar, Edward Prikryl, Edward J. Zilvitis

COLUMBUS BRANCH: Robert N. Keene, Leslie D. McGraw, William C. Schickner

DAYTON BRANCH: James H. Bernard, Holie Luechauer

DETROIT BRANCH: E. L. Beightol, Jr., D. M. Bigge, R. Blasiola, J. Breen, H. Buchanan, F. M. Covert, Carl D'Aquila, L. F. Dombroski, S. H. Dreisbach, O. Filer, J. B. Fisher, T. N. Gassen, B. F. Glass, R. J. Goeckel, F. H. Hartlep, R. E. Heath, C. W. Horn, J. E. Lawson, D. F. Mason, V. G. Matosh, H. J. Patterson, G. J. Rafferty, A. F. Robertson, S. W. Rodger, H. C. Rose, E. Schmidl, G. T. Sensor, R. D. Thomas, J. R. Valrance, W. R. Vincent, R. Voltman, R. H. Wiechert, R. M. Williams, A. Zimmerman

HARTFORD BRANCH: Ejvind C. Borggard, William A. Luca, Henry J. Trella

INDIANAPOLIS BRANCH: Walter H. Blanck, Donald F. Drogue, Clifford L. Gough, E. F. Manning, C. L. Shivey

LANCASTER BRANCH: Emil Wiegand

LOS ANGELES BRANCH: George E. Anson, Charles L. De Cuir, Florence English, P. L. Greathead, N. Donald Shaw, Edward F. Ward

LOUISVILLE BRANCH: Austin L. Luckett, Earl F. Taylor

MELBOURNE BRANCH: G. V. Gatens, H. J. Merton, C. E. Naylor, J. J. Wilson

MILWAUKEE BRANCH: N. F. Gerke, J. W. Ninnemann, C. F. P. O'Donohue

MONTREAL BRANCH: R. N. Fuller, Gerald R. B. Hastings

NEWARK BRANCH: Peter Arnold, Joseph Ludovico

NEW YORK BRANCH: Sebastian J. Abacco, Dominick A. Albino, Thomas Blair, Anthony P. Briganti, Otto Brill, Harry Eisenberg, John J. Fannon, Samuel M. Garte, Morris Greenberg, William K. McCown, Charles R. McGuire, Charles J. Petersen, Paul Reingold, Walter H. Robinson, Morton

MEMBERSHIP COMPETITION

	Membership April 1, 1949*	New Members	Net Change in Membership	Per Cent Net Change
FIRST GROUP				
DETROIT	427	34	+31	+ 7.3
NEW YORK	265	21	+18½	+ 7.0
CLEVELAND	186	8	+ 8	+ 4.3
MILWAUKEE	132	3	+ 1	+ 0.8
HARTFORD	133	3	+ 1	+ 0.8
PITTSBURGH	135	6	+ ½	+ 0.4
GRAND RAPIDS†	160			
CHICAGO	391	6	− ½	− 0.1
LOS ANGELES	217	6	− ½	− 0.2
PHILADELPHIA	187	2	− ½	− 0.3
BOSTON	153		− 1½	− 1.0
BRIDGEPORT	160		− 3	− 1.9
NEWARK	256	2	− 5½	− 2.1
TORONTO	154	6	−17	−11.0
SECOND GROUP				
BUFFALO	82	6	+ 7	+ 8.5
BALTIMORE-WASH.	83	5	+ 4½	+ 5.4
MELBOURNE	81	4	+ 3	+ 3.7
SYDNEY†	108	4	+ 4	+ 3.7
INDIANAPOLIS	104	5	+ 3	+ 2.9
PROV.-ATTLEBORO	109	3	+ 2	+ 1.8
DAYTON	98	2	+ 1	+ 1.0
NEW HAVEN	108		+ 1	+ 0.9
CINCINNATI	90			
ST. LOUIS	107			
WATERBURY	122	2	− 1	− 0.8
ST. JOSEPH VALLEY	80		− 1	− 1.2
SYRACUSE	83	2	− 4	− 4.8
ROCHESTER	125		−10½	− 8.4
THIRD GROUP				
COLUMBUS	38	3	+ 3	+ 7.9
SOUTHEASTERN	38	3	+ 3	+ 7.9
LOUISVILLE	20	2	+ 1½	+ 7.5
SPRINGFIELD	50	2	+ 2	+ 4.0
TOLEDO	56		+ ½	+ 0.9
ALLENTOWN-READING	43			
ROCKFORD	56			
JACKSON-LANSING	59			
LANCASTER	59	1		
SAGINAW VALLEY†	67			
ADELAIDE	76			
TWIN CITY	77	1		
SAN FRANCISCO	71	10	− 1	− 1.4
MONTREAL	69	2	− 2½	− 3.6
OUTSIDE COMPETITION				
WESTERN ONTARIO		15	+15	
IN TRANSFER	22		+15	
AT LARGE	100	7	+ 7	
TOTAL A. E. S.	5,237	176	+72	+ 1.4
Active Membership, June 1, 1949*			5,309	

*Subject to correction. †Winners of membership competition in 1948–1949.

Schliftman, William W. Sellers, Jr., Samuel J. Singer, Jr., Timothy C. Sullivan, Joseph Swantek, John Walter, Eugene Wassermann

PHILADELPHIA BRANCH: William B. Huey, Charles Stehlik, Jr.

PITTSBURGH BRANCH: William B. Boyde, Robert T. Graf, Henry Hienz, Roy D. Ruetz, Richard A. Wodehouse, Jr., Walter G. Zelley

PROVIDENCE-ATTLEBORO BRANCH: John E. Lozon, Henry Shavier, Jeremiah A. Wade

SAN FRANCISCO BRANCH: Frank F. Borg, Armand L. Delamothe, Thomas Fleming, M. Inglis, Jr., Anthony Mendolari, Raphael S. Novello, C. F. Owens, Carl S. Rankin, Joseph Rodriquez, Jack F. Violette

SOUTHEASTERN BRANCH: Ralph B. Goodson, Sr., Claude J. Nally, Richard E. Norman

SPRINGFIELD BRANCH: Edward J. Mahar, Donald R. Robbins

SYDNEY BRANCH: L. Aldridge, P. H. Justo, J. Peterson, A. L. Treherne

SYRACUSE BRANCH: Charles F. Benner, Theodore Yette

TORONTO BRANCH: A. L. Coxhead, Robert G. Haacks, Edwin S. Ogden, R. Phillips, H. Tissington, Katsumi Uyede

TWIN CITY BRANCH: Howard K. Norman

WATERBURY BRANCH: Louis Porretti, Kenneth C. Upright

WESTERN-ONTARIO BRANCH: A. V. Corbet, Harvey J. Curry, Edward F. Cygan, Roy T. Dufour, H. H. Hind, William Marks, N. Matte, M. H. McDonald, H. G. Oster, Robert A. Rawlings, N. J. Southern, W. H. Stewart, E. G. Turner, J. Volkes, H. G. Watson

MEMBERSHIP-AT-LARGE: Jaime E. Batlle, Fabio Becker, P. B. Deshpande, Leland D. Hawkins, George Rosenfeld, A. J. Spassenberg, Ernest Weiss

Reinstatements

BRIDGEPORT BRANCH: Hubert E. Conner

BUFFALO BRANCH: J. C. Logan

CLEVELAND BRANCH: Emil Pavlik, John H. Shope

DETROIT BRANCH: R. C. Fancher

GRAND RAPIDS BRANCH: Gerrit G. Herringa

NEW YORK BRANCH: E. Feldman

TOLEDO BRANCH: Kimsley Allison

Transfers

D. R. Bonner still member of Baltimore-Washington Branch; Maurice J. Krane to Baltimore-Washington Branch; James W. Shaw from Boston Branch; F. Rolf Morral, Lawrence J. Durney, and Frank J. Kozma from Bridgeport Branch; Arthur S. Lanson, Jr. from Bridgeport Branch to Hartford Branch; L. D. Ridenour to Cleveland Branch; Chester Lancaster and H. J. Huester from Dayton Branch; H. McCracken and D. F. Moeber to Detroit Branch; George T. Lindgrin from Hartford Branch; Erwin Sohn to Louisville Branch; Herbert E. Millwater and Edward Washburn from Newark Branch; Louis M. Hague from Pittsburgh Branch to Newark Branch; Lester Dicks and H. C. Schlaupitz to New Haven Branch; James M. Hite from Philadelphia Branch; Edgar Hollister from Rochester Branch to Syracuse Branch; Harry Matters from Syracuse Branch; Charles E. Campbell from Toledo Branch to Detroit Branch; H. J. Butterill from Toronto Branch to Montreal Branch; William Dunlop, D. E. Paton, E. T. Ferguson, A. S. Ellis, H. A. Deen, Herbert Fallows, William Finlay, Daniel Mundy, and William Young from Toronto Branch; R. Connors to Chicago Branch; G. S. Woodruff from Cleveland Branch; G. J. Mitchell to Dayton Branch; J. A. Cappi from Dayton Branch; J. Hoefer from Detroit Branch to Jackson-Lansing Branch; W. H. Megle and E. Sampson from Detroit Branch; W. M. King from Jackson-Lansing Branch; Jerome L. Ross from Los Angeles Branch; George E. Vibberts, Jr. to New York Branch

Resignations

BALTIMORE-WASHINGTON BRANCH: Archibald Jones, Jr.

BRIDGEPORT BRANCH: Herbert E. Conner, Herbert G. Runde

CHICAGO BRANCH: F. M. De Beers, Henry Hauseman, Donald A. Hilliard, J. Kretschmer, A. Saudecki

CLEVELAND BRANCH: A. D. Sopher

DETROIT BRANCH: L. Lester, C. W. Yerger

GRAND RAPIDS BRANCH: L. C. Kroes

HARTFORD BRANCH: Daniel J. Lanza, William J. Schiffer

INDIANAPOLIS BRANCH: R. M. Wagner, E. L. McKinney

LANCASTER BRANCH: Newton N. Fisher

LOS ANGELES BRANCH: J. M. Beatty, James Poulson, Calvin B. Morris, R. W. Shill, F. Boyd Stillings

LOUISVILLE BRANCH: George Perkins

MELBOURNE BRANCH: L. S. Rogers

MONTREAL BRANCH: Raymond H. Loehrke

NEWARK BRANCH: Gerald G. Ascione, Edward Bauer, Charles E. Bloom, Ralph A. Heiss, Andrew J. Neafie, James W. Phelps, Herbert B. Sill

NEW YORK BRANCH: John Burke, Alfred Pritchard

PHILADELPHIA BRANCH: G. C. Ruckel

PITTSBURGH BRANCH: S. V. Bell

PROVIDENCE-ATTLEBORO BRANCH: James Warren

ST. JOSEPH VALLEY BRANCH: Don Reid

SAN FRANCISCO BRANCH: S. Dan Brodie, Farnsworth Currier, B. P. Milo

SYRACUSE BRANCH: F. W. King

TORONTO BRANCH: Percy Cockfield, D. Fleming, J. M. Kirkby, J. Vallier

TWIN CITY BRANCH: O. W. Nealy

Suspensions

CHICAGO BRANCH: R. V. Miner, B. E. Towner

CLEVELAND BRANCH: Joseph Mutko

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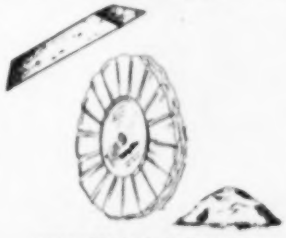

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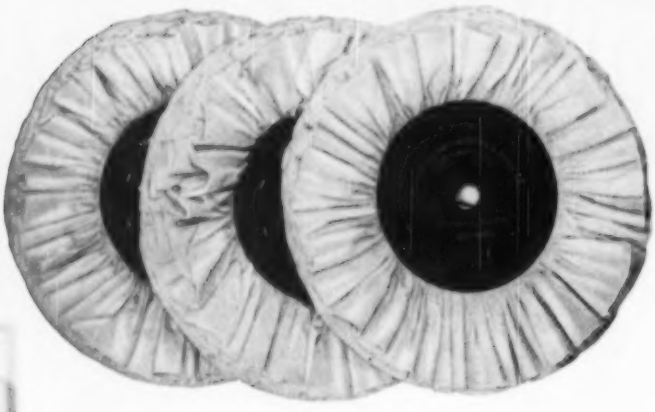

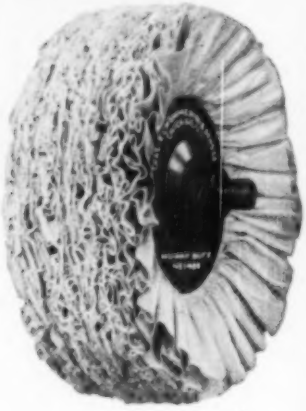

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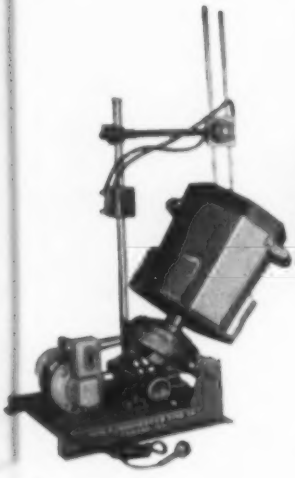

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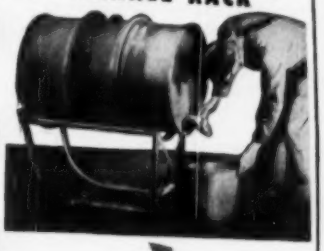

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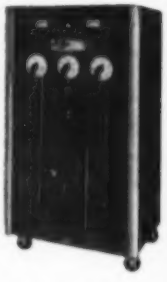

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Plating

June 30, 1949

Subject: A.E.S. Milwaukee Convention

Dear Reader:

This issue is being held up for a few days to give you this short bulletin from the American Electroplaters' Milwaukee Convention.

The attendance was very satisfactory, totaling 1,003, of which 250 were ladies.

The technical and entertainment programs went off without a hitch, thanks to excellent planning and organization by the Milwaukee Branch Committee headed by Bill Geissman.

The International Fellowship Club, which served as host at several of the social events, elected new officers as follows: President, Rudy Hazucha, Clinton Company; First Vice-President, George Nankervis, George Nankervis Company; Second Vice-President, A. P. Munning, Munning and Munning Company; Third Vice-President, Al Braun, Agate Lacquer Company; Permanent Secretary, T. A. Trumbour, Finishing Publications.

Among important business matters transacted during the business sessions by the A.E.S. Delegates were three changes in By-Laws to facilitate operation of the Society and its Branches.

Not less than four Society members were elected to honorary membership. These were Thomas F. Slattery, Baltimore-Washington Branch; Joseph P. Sexton, Bridgeport Branch; John Lockerbie, St. Joseph Valley Branch; and Edward J. Musick, St. Louis Branch.

Perhaps of greatest interest is the election of officers. Last year's officers were moved up one step, with the immediate Past President's position now being held by S. S. Johnston. A. W. Logozzo is the new President; W. J. Neill, First Vice-President; and C. F. Nixon, Second Vice-President. The newcomer on the Executive Board is Franklyn J. MacStoker, of New York Branch, Third Vice-President. Mr. MacStoker is connected with the Ferrand Optical Company, New York, and has a long record of service to the A.E.S. He has been Secretary-Treasurer of New York Branch for at least 15 years and has held other positions of prominence.

Paper awards given for outstanding contributions during the year and at the Convention were as follows: Founders' Gold Medal to W. A. Wesley, W. W. Sellers and E. J. Roehl; $50 Plating Award to Lyman Sperry and Maurice Caldwell; A.E.S. Gold Medal to C. F. Nixon; Mechanical Finishing Award of A.E.S., sponsored by Lea Manufacturing Company, to Arthur P. Schulze, and Chromium Plating Award of A.E.S., sponsored by Nutmeg Chrome Corporation, to Robert Seegmiller and Vernon A. Lamb.

Best Branch Exhibit Awards went to Columbus (First Prize), Twin City (Second), and Chicago (Third).

Chicago was selected by Convention Delegates as the site for the 1952 Convention. It has been recommended that an Industrial Finishing Exposition be held in conjunction with this Convention. Boston for 1950 and Los Angeles for 1951 had previously been selected as convention sites.

Sincerely,

Gustaf Soderberg

Editor

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